CIRCULAR No. 16 OCTOBER, 1927
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

SOME ECONOMIC ASPECTS OF THE MARKETING OF MILK AND CREAM IN NEW ENGLAND

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CONTENTS

INTRODUCTION

During the past decade an increasing share of public interest has been centered upon the value of milk as a food, and its necessity as an article of diet has been emphasized by scientific studies. The numerous problems arising in the production, handling, and marketing of increasing quantites of fluid milk and cream led 25 farmers' cooperative associations to request an economic study of the marketing of milk and cream in New England. The purpose of this study was to obtain and analyze the economic facts surrounding the production and marketing of milk and cream in the New England States as an aid in the development of a plan for cooperative marketing and a better program of production.

This study was undertaken by the Division of Cooperative Marketing, and the associations requesting the study, made available for the purpose much valuable information from their records. In making the study, the representatives of the United States Department of Agriculture had the cooperation of the officials and staff workers of

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the agricultural experiment stations and the extension divisions and departments of agriculture of the several States involved.[1]

Data on milk production and utilization, on marketing facilities and methods of distribution, on prices of milk at retail and to producers, on the relation of price changes and other factors to production, and on freight rates and transportation methods were collected from various sources. These data were analyzed, and the results of the analysis are presented in this circular.

The study was made in a relatively brief space of time and is not presented as a complete treatment but as a rapid survey for the purpose of obtaining data which would be helpful in solving some current problems in the New England milk-marketing situation. Some important phases of these problems have been covered in a rather preliminary fashion, because of limitations of time and available source material. They are presented here as indicating the possibilities of further analyses as well as the factors which must be considered in the development of an efficient marketing organization.

NEW ENGLAND'S MAJOR MILK AND CREAM MARKET

The flow of New England's milk supply is toward the regions of greatest population density. These regions are to be found in industrial southern New England. (Fig. 1.) Vermont had, in 1925, one-third of all the cows in New England. This State produced, in 1925, more than 29.6 per cent of the entire 4,026,000,000 pounds[2] annual milk production of New England. (Fig. 2.) Its farm population constitutes 35 per cent of its total population of 362,428.[3] In contrast with Massachusetts, the annual milk production of which is 23 per cent of the New England production but the urban population of which is 97 per cent of a total of 3,852,356[3] inhabitants, there is, on the one hand, a State in which supply far exceeds its needs, and, on the other hand, a State whose needs greatly exceed its supply.

As stated by R. J. McFall, of the Massachusetts Agricultural College, "Connecticut produces more milk than it consumes in fluid form. As a consequence, and with the help of an efficient marketing system, practically all of the milk for the cities of this State comes from near-by towns within the State. The middle and northern towns along the western part of Connecticut and the towns in the southern part of Berkshire County, which is the western end of Massachusetts, ship milk into New York. These towns also supply

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[1] The sections of this circular on "Relation of retail prices to consumption," "Relation of basic economic factors to milk price policies," and "Influence of producer prices upon milk supply" were prepared by M. J. B. Ezekiel, agricultural economist, Bureau of Agricultural Economics; the sections on "Plans for producer control of production and price" and "Economical size for milk plants" were prepared by Hutzel Metzger, agricultural economist, Division of Cooperative Marketing. F. A. Buechel, Division of Poultry and Dairy Products, assisted in collating the data on utilizaton of milk tank cars. C. E. Clement, Bureau of Dairy Industry, of this department, conducted the survey of New England country milk stations and prepared the floor plans and cost estimates. Material brought out in studies by Eldon C. Shoup, agricultural economist, and R. J. McFall, of the Massachusetts Agricultural College, was freely drawn upon in the course of the study. Acknowledgment is made to Walter L. Haynes, who assisted in the study, and to H. I. Richards and W. W. Michaud, of the New England Research Council; to W. H. Bronson, New England Milk Producers' Association; to H. P. Young and H. B. Ellenberger, and to A. R. Gans, University of Vermont; to H. E. Bremer, Vermont Department of Agriculture; and to the milk-traffic officials of the New England railroads for much information and assistance throughout the study.

[2] New England Crop and Livestock Review—1924 and 1925, issued by the United States Department of Agriculture cooperating with the New England departments of agriculture.

[3] United States Department of Agriculture—Yearbook, 1925, p. 1402.

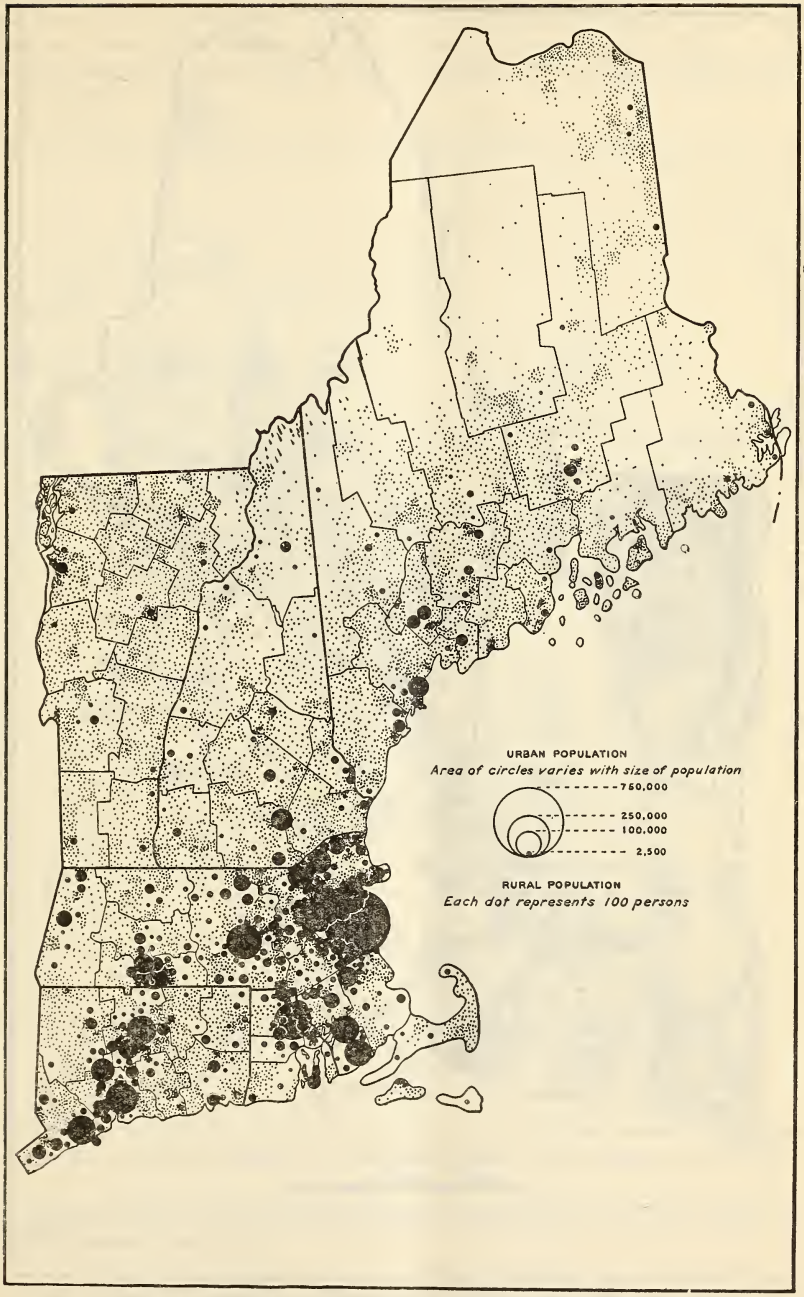

FIG. 1.—POPULATION URBAN AND RURAL OF NEW ENGLAND STATES, 1920

New England's rural population is well distributed, but its urban population is largely concentrated in the southern part. (Based on Bureau of Census.)

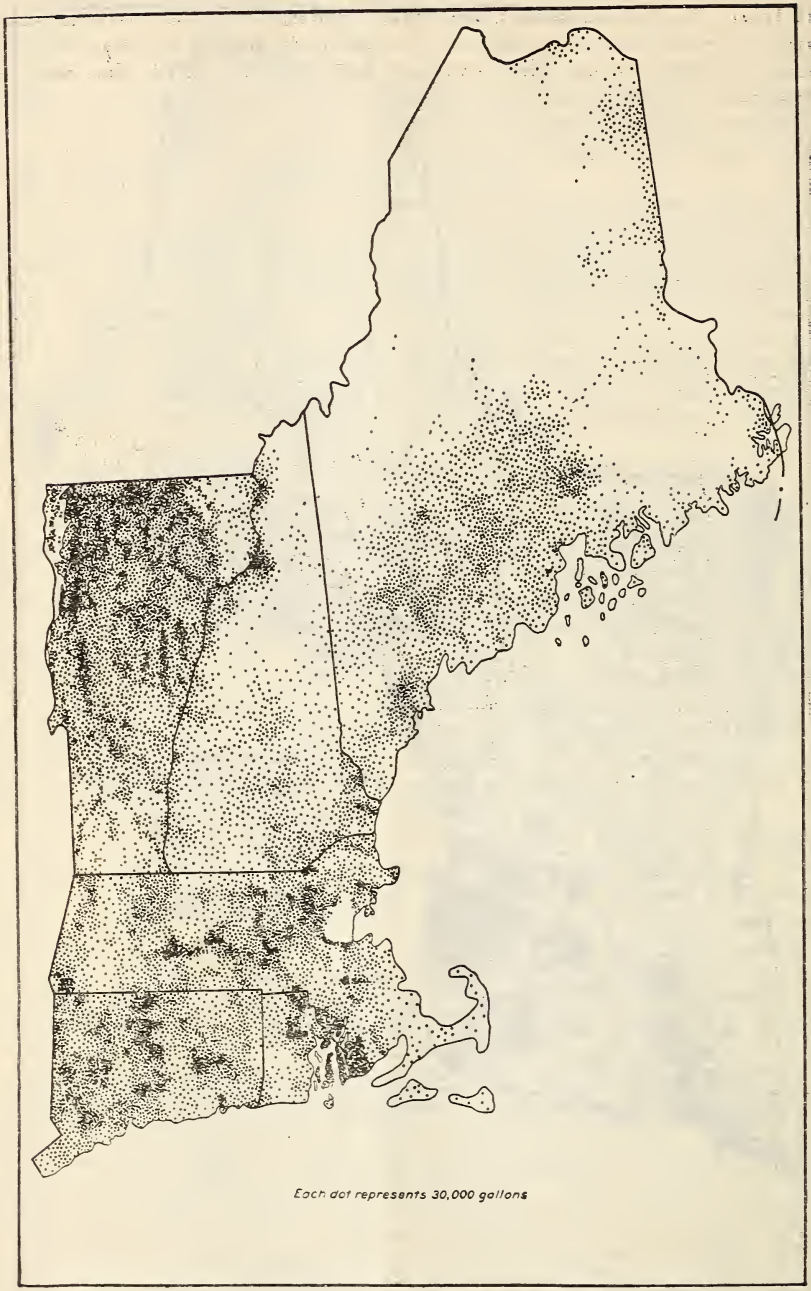

FIG. 2.—MILK PRODUCED IN NEW ENGLAND STATES IN 1924

In 1924 Vermont produced about 30 per cent, Massachusetts about 23 per cent, Maine 17 per cent, and Connecticut 16 per cent of all the milk produced in New England. (Based on Bureau of Census.)

themselves with milk and some is shipped from the western Connecticut towns to Connecticut cities, but a substantial part of the milk shipped from this whole section flows to New York City. A few towns scattered along the western border of Vermont also ship to New York."

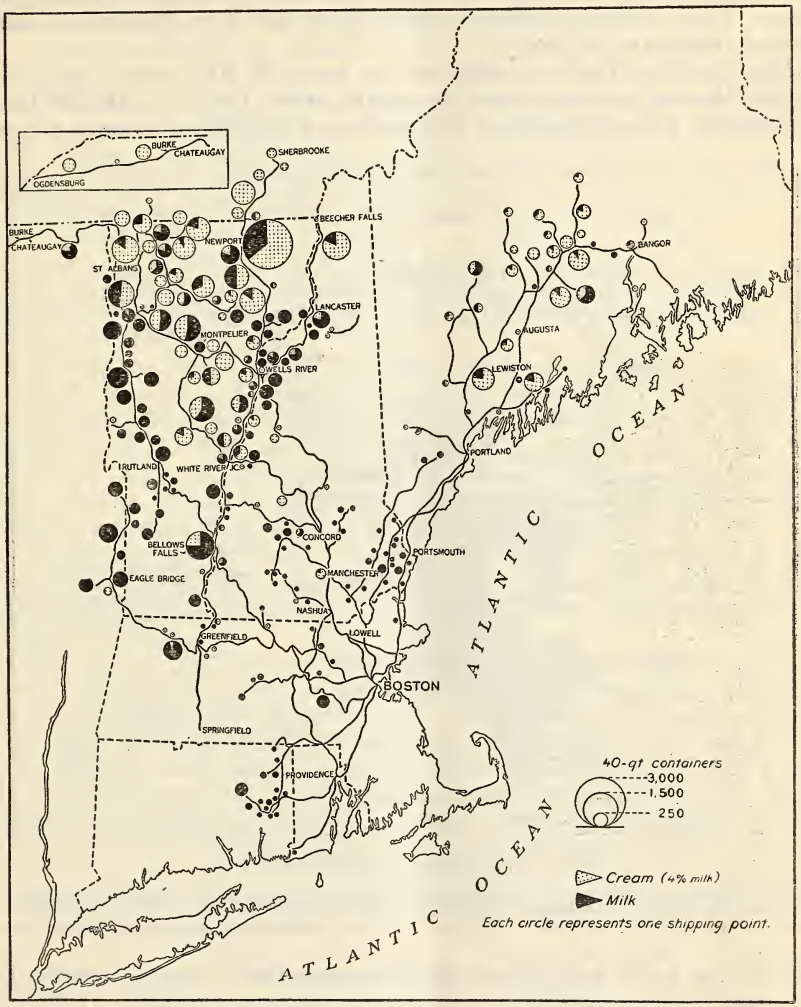

FIG. 3.—UPPER NEW ENGLAND DAILY MILK AND CREAM TRAFFIC BY RAIL, MARCH, 1926

The sources of the milk and cream supply of Boston are to be found largely in Vermont. (Based on information supplied by W. H. Bronson, of the New England Milk Producers Association.)

Of all the New England States, Vermont becomes the keystone in the milk-supply arch (fig. 3) and Massachusetts the keystone in the demand arch.

Metropolitan Boston, consisting of Boston proper and 39 other municipalities, constitutes the largest single market for New Eng-

land's milk and cream. It alone absorbs more than two-thirds of all New England interstate rail movement of these commodities.

Such cities as Hartford, New Haven, and Bridgeport, Conn.; Providence, R. I.; Worcester, Springfield, Fall River, New Bedford, and Lowell, Mass.; each with a population well over 100,000, form secondary markets of importance in the New England market-milk area. They consume nearly one-third of all New England's milk moved interstate by rail.

Metropolitan Boston comprises an area of 409 square miles, of which Boston proper covers 48 square miles (fig. 4). In 1920 the population of metropolitan Boston was 1,772,254, or about 46 per

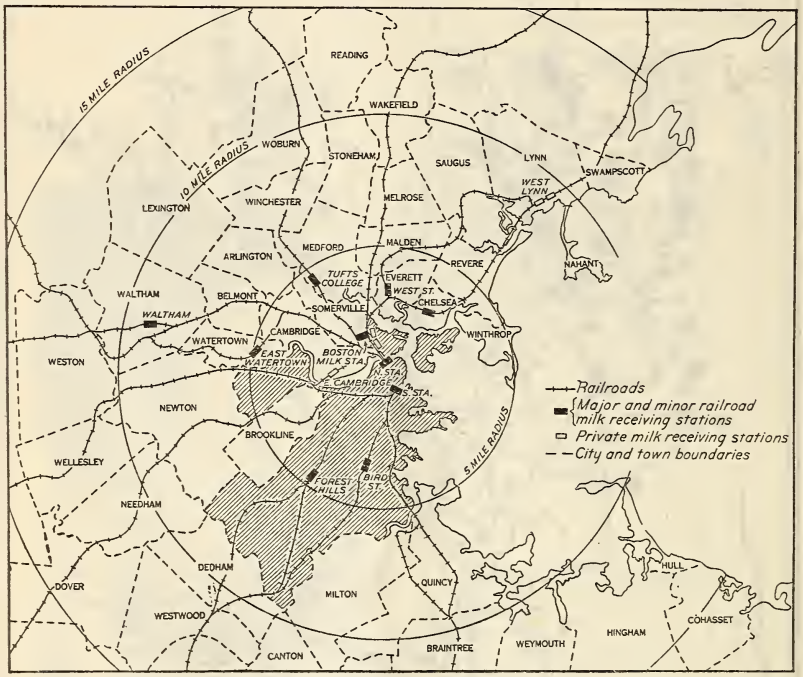

FIG. 4.—METROPOLITAN BOSTON, 1927

Milk-receiving stations of metropolitan Boston are located in areas of greatest population density and traffic congestion. The outward growth of population will necessitate augmenting present facilities with new stations in outlying municipalities.

cent of the total population of Massachusetts.[4] Approximately 65 per cent of the population of Boston proper consisted of native whites, and 32 per cent were foreign-born whites. Of the total population, 7.6 per cent were born in Ireland, 5.1 per cent in Italy, 5.1 per cent in Russia, 1.7 per cent in England, 1 per cent in Poland, and 1 per cent in Sweden. It is not known precisely what relationship exists between racial characteristics and milk consumption in a given area, but it is possible that further research into the matter would bring out some significant facts which would be of use in organizing facilities for distribution.

[4] United States census, 1920.

In 1900 Boston drew its milk supply largely from Massachusetts and southern New Hampshire, but the rapid growth of metropolitan Boston, with its diversity of industry, commerce, and population, resulted in a reaching out still farther, both northward and westward, for a supply of milk and cream. Figure 5 shows sources in New England and adjacent sources of milk and cream sent by rail to the Boston market as of 1900, 1910, 1920, and 1926.

In 1926 metropolitan Boston brought milk from as far west as Ogdensburg, N. Y., a distance of 391 miles; as far north as Newport, Vt., a distance of 231 miles; and as far northeast as Dover-Foxcroft, Me., a distance of 246 miles. Some of its cream supply during the fall, winter, and early spring months came from as far west as Kansas and as far north as Quebec.

The following 13 railroads handle regularly (each day) at least one car of milk or cream into Boston: [5]

Boston & Maine, Central Vermont, Rutland, Maine Central, New Haven, Boston & Albany, Delaware & Hudson, Greenwich & Johnsonville, St. Johnsbury & Lake Champlain, Montpelier & Wells River, Belfast & Moosehead Lake, Suncook Valley, and Canadian Pacific.

"On an average about 27,000,000 quarts of milk and cream are handled by rail each month, two-thirds of which is delivered to metropolitan Boston. Cream makes up about 10 per cent of the total quarts handled. The traffic is increasing in volume each year, the deliveries in Boston in 1925 being 90 per cent greater than those of 1915. There are seasonal fluctuations which cause the daily deliveries in June to exceed those in January by about 20 per cent." [6]

On the basis of 10 quarts of milk to a quart of cream, the cream shipped as noted above represents a larger quantity of milk potentially available for shipment as fluid milk than has recently been shipped as such.

The magnitude of the annual volume of milk and cream flowing to greater Boston is shown in Table 1. It will be seen that Vermont overshadows all of the other New England States in volume of milk and cream moving to Boston. The low volume of the daily movement of milk and cream to metropolitan Boston from some of the other States shown in the table can be accounted for in that these States have a large number of smaller, neighboring markets, which absorb some of the milk surplus produced. Movements from Canada and the Central and Western States, though small, are in fact more significant than they appear, in that they represent practically 100 per cent cream shipments.

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[5] Interstate Commerce Commission, Brief on Behalf of Carriers, I. and S. Docket No. 2635, p. 2.

[6] Interstate Commerce Commission, Brief on Behalf of Carriers, I. and S. Docket No. 2635, p. 4.

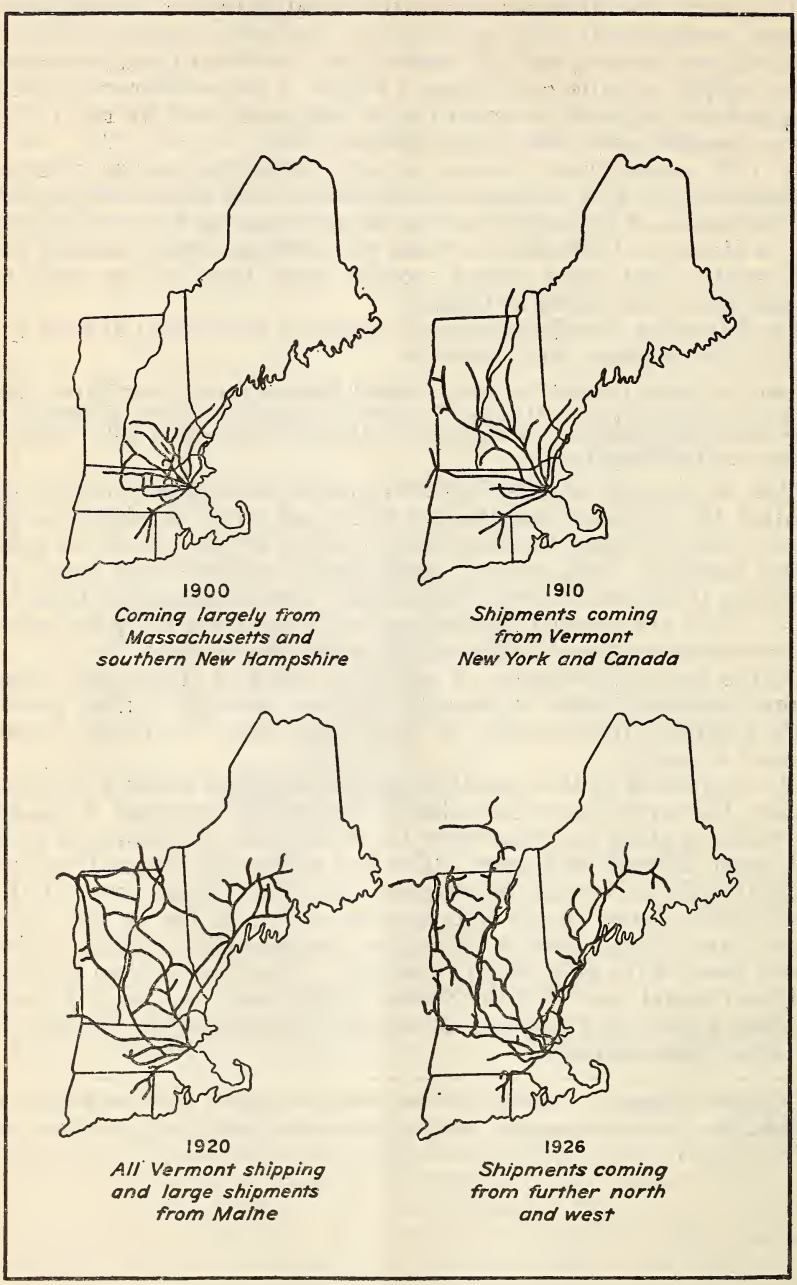

FIG. 5.—SOURCES OF MILK AND CREAM BY RAIL TO BOSTON MARKET

The expansion of the milk shed of metropolitan Boston has been rapid during the past two decades.

TABLE 1.—*Annual volume of milk and cream receipts by rail in Metropolitan Boston, 1921–1927*

Year	Total shipments	Percentage of total originating in State indicated							
		Maine	New Hampshire	Vermont	New York	Massachusetts	Connecticut	Canada	Central and Western States
Milk:	*1,000 quarts*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1921	150,000,000	14.7	12.0	42.6	18.7	8.7	3.3	-------	-------
1922	159,000,000	11.3	12.0	45.9	18.2	9.4	3.2	-------	-------
1923	164,000,000	9.8	10.4	48.8	20.1	8.5	2.4	-------	-------
1924	172,000,000	9.3	8.1	54.1	19.8	7.0	1.7	-------	-------
1925	179,000,000	8.4	7.2	56.4	20.7	5.6	1.7	-------	-------
1926	185,000,000	7.6	6.5	62.2	16.2	5.9	1.6	-------	-------
1927	[1] 193,000,000	-------	-------	-------	-------	-------	-------	-------	-------
Cream:									
1921	18,300,000	22.4	7.6	48.1	8.8	1.6	-------	11.5	-------
1922	18,900,000	19.1	6.3	54.0	9.5	1.6	-------	9.5	-------
1923	19,300,000	19.2	5.7	53.9	9.8	2.1	-------	9.3	-------
1924	19,000,000	18.4	7.4	50.5	7.9	2.6	-------	13.2	-------
1925	20,200,000	18.8	4.4	51.5	9.9	2.0	-------	12.4	1.0
1926	23,700,000	17.3	6.8	50.6	7.2	1.7	-------	14.3	2.1
1927	[1] 29,000,000	-------	-------	-------	-------	-------	-------	-------	-------
Combined milk and cream:[2]									
1921	333,000,000	18.9	9.6	45.7	13.2	4.8	1.5	6.3	-------
1922	348,000,000	15.5	8.9	50.3	13.5	5.2	1.4	5.2	-------
1923	357,000,000	14.9	7.8	51.5	14.6	5.1	1.1	5.0	-------
1924	362,000,000	14.1	7.7	52.2	13.6	4.7	.8	6.9	-------
1925	381,000,000	13.9	5.8	53.8	15.0	3.7	.8	6.5	.5
1926	422,000,000	13.0	6.6	55.7	11.1	3.6	.7	8.1	1.2
1927	[1] 483,000,000	-------	-------	-------	-------	-------	-------	-------	-------

[1] Estimates based on growth of past 6 years and trend of production.
[2] Cream volume in 4 per cent butterfat milk equivalents.

Source—basic data from New England Milk Producers Association and New England railroad reports.

MOVEMENT OF MILK AND CREAM INTO METROPOLITAN BOSTON

About 90 per cent of the milk and cream supply of metropolitan Boston moves by rail. The rest of the supply is hauled by wagon or truck from near-by producing sections. At present the bulk of the milk supply comes from zones in Vermont and New Hampshire, 180 to 240 miles from Boston (figs. 6 and 7).

Vermont furnishes 62 per cent of the total milk supply of metropolitan Boston received by rail. (Tables 1 and 2.) Examination of Figure 8 shows that while Vermont's percentage has been steadily increasing, those of all the other States have steadily decreased. (Figs. 8 and 9.) In New Hampshire, Massachusetts, New York, and Connecticut most of the total production has been consumed in local markets other than Boston.

The cream supply of metropolitan Boston comes from more distant areas than does the milk supply. In spite of an import duty of 20 cents per gallon on cream that contains not more than 45 per cent of butterfat, Canadian shipments have steadily increased. In 1926 Canada supplied 14 per cent of the total receipts of cream in metropolitan Boston. In 1924 a negligible quantity of cream moved from points west of Buffalo. In 1926, the Western States supplied more than 2 per cent. Maine, New York, and Massachusetts show a declining percentage. New Hampshire shows an increasing percentage.

TABLE 2.—*Estimated average daily milk and cream receipts by rail, metropolitan Boston, 1921–1927* [1]

Year	Average daily receipts of milk and cream (car-lot and less-car-lot shipments; 8,560 quarts equals one car)								
	Total from all sources	Vermont	Maine	New Hampshire	Massachusetts	Connecticut	New York	Canada	West of Buffalo
Milk:	*Cars*	*Cars*	*Cars*	*Cars*	*Cars*	*Cars*	*Cars*	*Cars*	*Cars*
1921	48.0	20.5	7.1	5.6	4.2	1.6	9.0	----------	----------
1922	50.9	23.4	5.7	6.1	4.8	1.6	9.3	----------	----------
1923	52.5	25.6	5.1	5.4	4.5	1.3	10.6	----------	----------
1924	55.1	29.8	5.1	4.5	3.9	.9	10.9	----------	----------
1925	57.3	32.3	4.8	4.1	3.2	1.0	11.9	----------	----------
1926	59.2	36.8	4.5	3.9	3.5	.9	9.6	----------	----------
1927	[2] 61.8	----------	----------	----------	----------	----------	----------	----------	----------
Cream:									
1921	5.86	2.82	1.31	.45	.09	----------	.52	.67	----------
1922	6.05	3.27	1.16	.38	.10	----------	.57	.57	----------
1923	6.17	3.33	1.19	.35	.13	----------	.60	.57	----------
1924	6.08	3.07	1.12	.45	.16	----------	.48	.80	----------
1925	6.47	3.33	1.22	.28	.14	----------	64	.80	.06
1926	7.59	3.84	1.31	.51	.13	----------	55	1.09	.16
1927	[2] 9.30	----------	----------	----------	----------	----------	----------	----------	----------

[1] Estimates computed from data furnished by the New England Milk Producers Association.
[2] Estimate based on growth of past six years.

"About 50 per cent of the traffic is handled in less-carload or open cars, but owing to their lighter loading, the less-carload cars make up about 66 per cent of the total cars operated. The average loading of less-carload cars is 186 40-quart cans, and 269 cans for carload shipments." Estimate computed from data furnished by the Interstate Commerce Commission, I. and S. Docket No.2635, Brief on Behalf Carriers, p. 5.

The seasonal movement of milk and cream by rail to metropolitan Boston is rather uniform, although there are days or periods within each season when, because of very warm weather, there is a call for an extra quantity of both milk and cream. Cold-weather periods have an opposite effect upon consumption. The day-of-week receipts, however, are somewhat irregular (fig. 10). Because of the influence of licensed-store selling of milk and cream, Friday's receipts, which become Saturday's sales, are heavy. The use of cream in making ice cream for Sunday also tends to increase the Friday receipts. Stores are not open on Sunday, and this fact largely accounts for the low receipts on Saturday.

The traffic maps (figs. 11 and 12) illustrate the railroad channels of flow of both milk and cream from the producing areas to metropolitan Boston.

The localities nearest metropolitan Boston, or those on rail points having good train service to metropolitan Boston, ship largely fluid milk. The more distant localities, or those from which rail service is not so fast, ship more cream than milk.

WAGON AND TRUCK HAUL

The wagon and truck haul into metropolitan Boston is confined to a radius of 70 miles from the heart of the city. The volume thus handled represents less than 10 per cent of the total daily supply. This percentage is materially lower than for some other cities comparable in size, east of the Mississippi and north of the Ohio Rivers, for milk production near Boston is relatively light and delays en route in hauling milk, due to congestion of highway traffic, act as

deterrents to any great increase in the quantity of milk hauled in by truck. Also, truck-hauling charges for distances greater than 30 or 40 miles are usually higher than are rail freight charges now in effect.

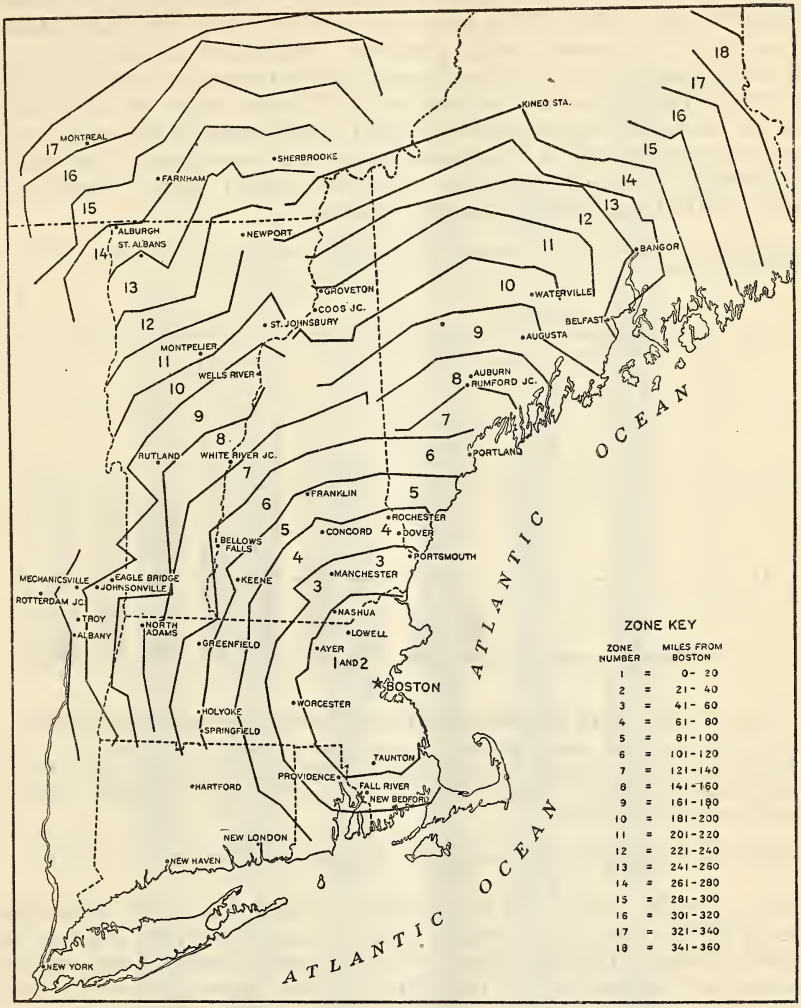

FIG. 6.—BOSTON MILK AND CREAM RAIL FREIGHT-RATE ZONES

The bulk of the Boston milk supply comes from zones in Vermont and New Hampshire, 180 to 240 miles from Boston. Freight rates on all milk and cream shipped from points in New England are varied according to 20-mile concentric zones. Rates increase with each zone. The irregular appearance of zones on the map is due to the fact that distances are measured along railway lines.

Near-by milk producers find it advantageous to sell their milk for fluid consumption rather than to skim it for cream.

Some factors, however, will probably tend to hasten the advent of motor trucks for hauling milk over all except the most impassable roads. General increase in milk consumption (Table 11) necessitates

expansion of area covered to supply demand. Increased competition between markets for milk in certain production areas will force the expansion of hauling areas. Competition with other near-by milk plants will make quick delivery necessary. Consolidation of milk plants will make competition keener for low-volume, high-cost plants. Extension of improved roads, passable throughout the entire year, will make possible the increased use of motor trucks in some sections. The recent increase of 20 per cent in rail freight rates in New England for distances up to 100 miles will cause some of the milk previously moved by rail in local zones to move by auto trucks and auto-tank trucks. Greater volumes of milk offered along truck-haul routes should tend to lower hauling charges.

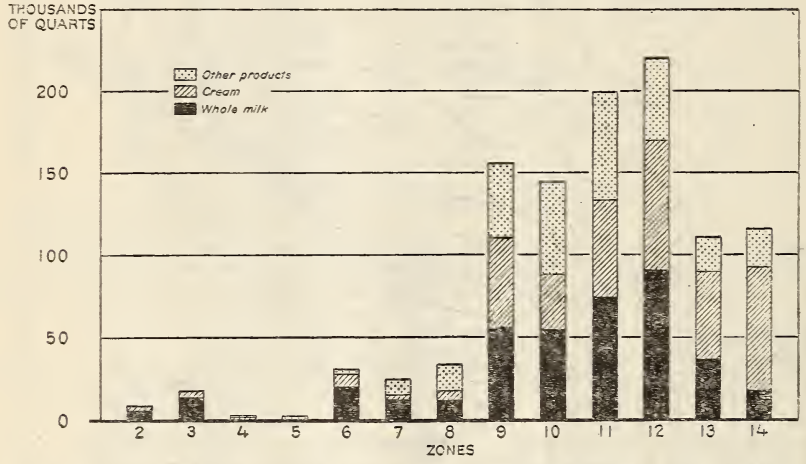

FIG. 7.—TOTAL MILK HANDLED IN VERMONT AND NEW HAMPSHIRE, 1926

The milk supply of metropolitan Boston originates largely in freight zones 9, 10, 11, and 12; but its sources of cream supply extend several zones farther. The tendency is to widen the area of fluid-milk supply and to push the cream areas farther north and west. (Source of data: Vermont and New Hampshire State departments of agriculture.)

PROBABLE EFFECT OF RECENT CHANGES IN FREIGHT RATES

After a milk and cream producing territory has been developed under a given schedule of freight rates and train service, changes in producer prices, freight rates, or train service may work in the direction of promoting or retarding further development in that territory.

The freight rates in effect from August 26, 1920, to June 10, 1927, and the existing train service did much to determine the direction of the development of milk production in New England. Under these conditions production of milk and cream in northern and western Vermont increased. Prior to 1920[7] many sections that produced milk were forced to manufacture it into butter, cheese, and other milk products because of freight rates and a system of car leasing. The abolition of the "leased-car" system and the change in rates in 1920 opened these sections to the milk-and-cream market of metropolitan

[7] According to studies by H. A. McFall, Massachusetts Agricultural College.

Boston. Some sections that were shipping cream at that time later found it advantageous to ship fluid milk.

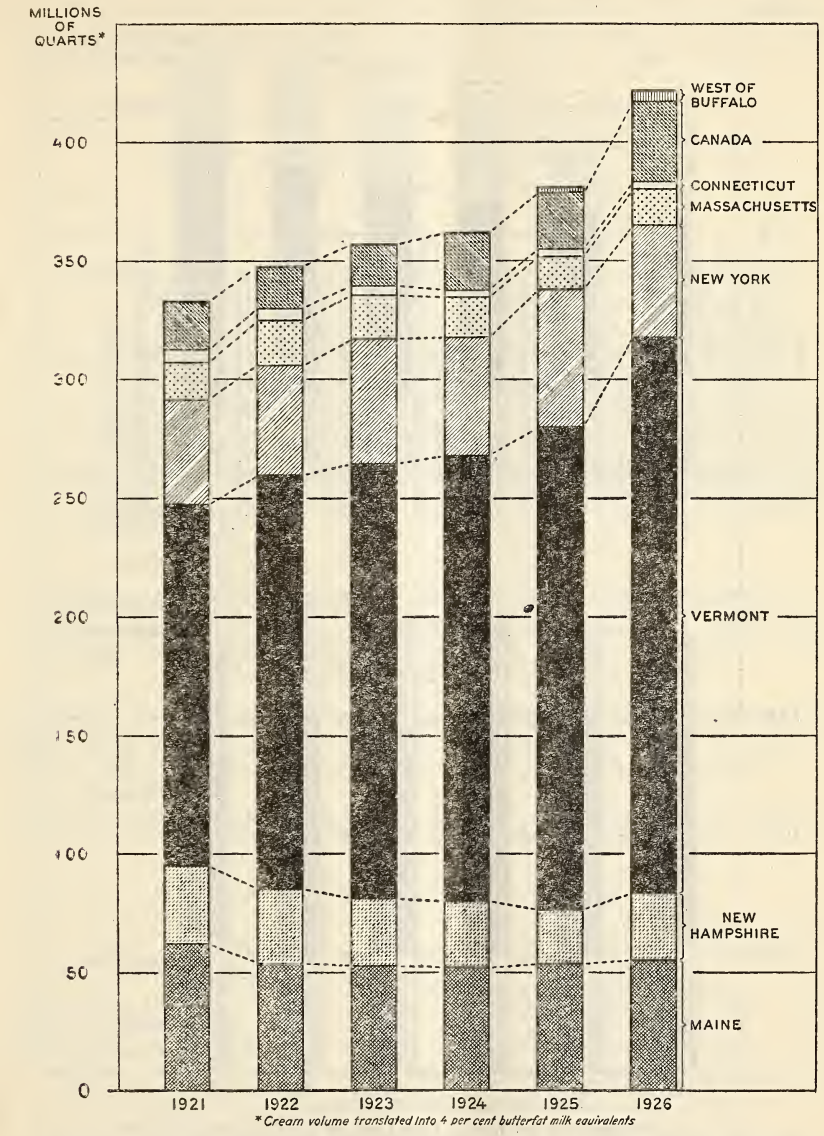

FIG. 8.—COMBINED SHIPMENTS OF MILK AND CREAM BY RAIL TO BOSTON

Vermont is steadily increasing its proportion of the milk and cream supply of metropolitan Boston, while the other New England States are either holding their own or are gradually decreasing their proportion. (Source of data: New England Milk Producers Association.)

During the past few years New York City has been reaching into western Vermont for an increasing supply of milk and cream, particularly milk.

The milk-shed divide between metropolitan Boston and New York City, in western Vermont, established itself for the period 1920 to

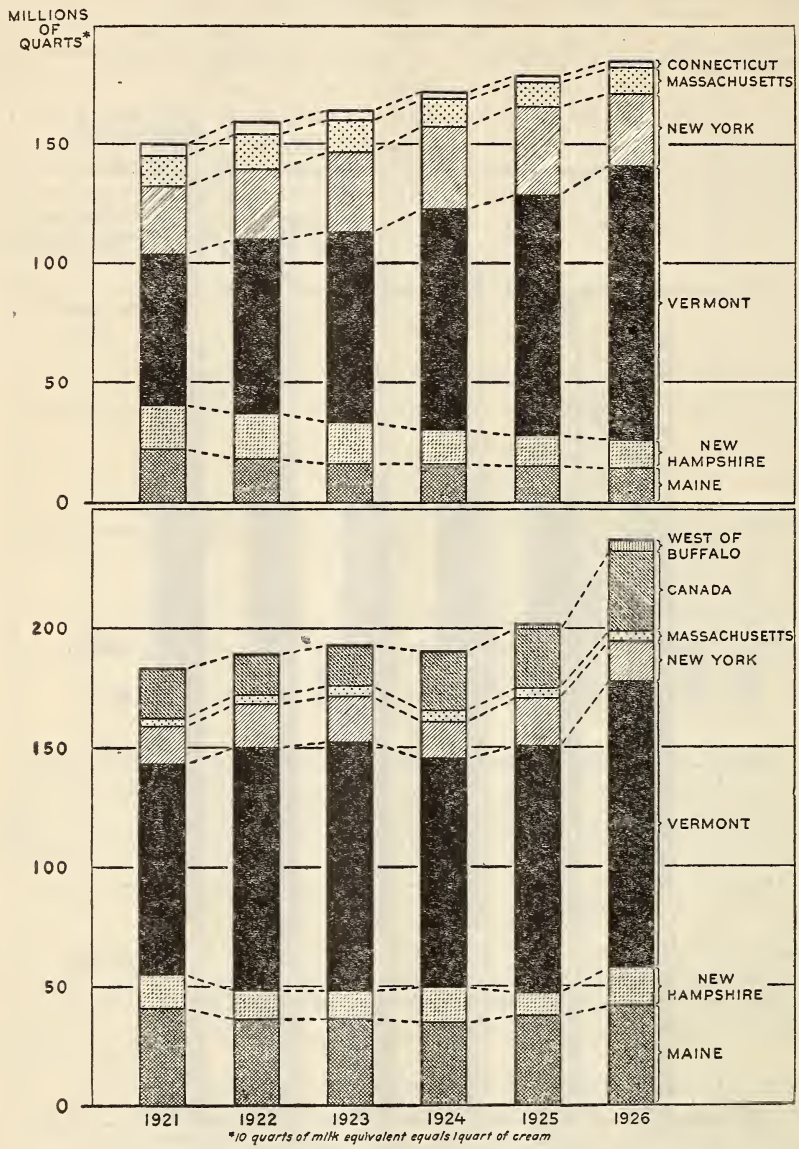

FIG. 9.—SHIPMENTS OF MILK AND CREAM BY RAIL TO BOSTON

From the standpoint of the milk and cream supply of metropolitan Boston, Vermont's volume is rapidly increasing. Some of the other States, like Maine and New Hampshire, are shifting their shipments from milk to cream. Canada and the Middle Western States, particularly the latter, are growing factors in Boston's cream supply. The upper chart represents milk and the lower chart represents cream. (Source of data: New England Milk Producers Association.)

1926, roughly, 10 miles east of the Rutland Railroad along points from New Haven Junction to East Dorset. During the last three years the tendency of those who ship to New York City has been

to force the dividing line further eastward and to consolidate the territory thus acquired. There were economic reasons why the milk produced in this territory should flow either to New York City or to Boston. Table 3 shows the flow from western Vermont to New York, Boston, and other destinations. Whether the producers should ship to one market or another depended upon shipping conditions,

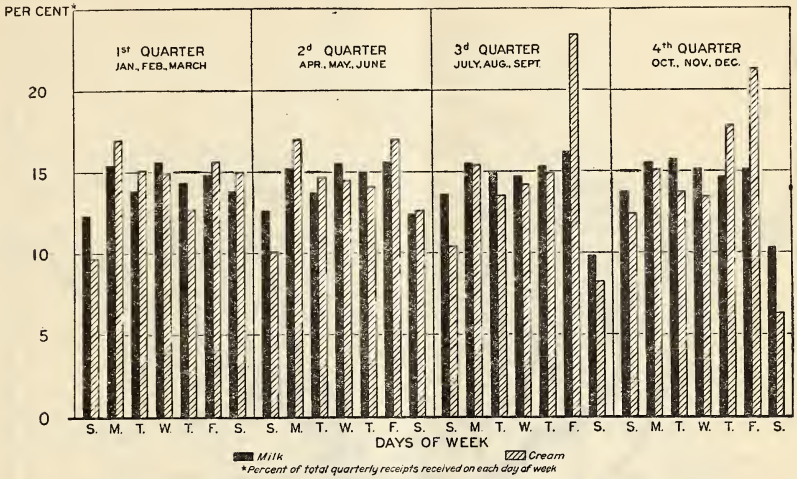

FIG. 10.—MILK AND CREAM RECEIPTS AT GREATER BOSTON, 1926

Cream received in Boston on Friday is consumed on Sunday. Saturday's low milk and cream receipts are delivered by wagon on Sundays. Stores are not open on Sundays. (Source of data: Boston & Maine Railroad.)

facilities, and prices received. The crowding of the New York City milk shed eastward into western Vermont took place in spite of higher freight rates per mile to New York City than to Boston.

TABLE 3.—*Average daily shipments of milk from Rutland Railroad stations in Vermont, for stated months in 1926*

[Compiled from data obtained from records of the Rutland Railroad]

Destination	January	March	June	September
	Quarts	*Quarts*	*Quarts*	*Quarts*
New York City	19,904	28,181	21,106	24,355
Metropolitan Boston	64,539	70,818	59,842	57,586
Interline stations	35,345	31,570	67,643	38,538
All other interline points	5,264	704	8,212	8,628
Total	125,052	131,273	156,803	129,107

In the spring of 1926 the New England railroads petitioned the Interstate Commerce Commission for a 20 per cent vertical increase in all freight rates on milk and cream. The milk shippers protested this increase. After several hearings the Interstate Commerce Commission granted what was, in effect, an increase of 20 per cent in milk-and-cream rates in zones 1 to 5, inclusive, and an increase of 10 per cent in rates for zones above the fifth. These new rates became effec-

tive June 10, 1927 (fig. 13). As the matter now stands, freight rates on milk and cream in New England are substantially those obtaining for the New York City milk shed in all zones above the fourth. From the first to the fourth New England zones the rates are lower than for equivalent zones in the New York City milk shed.

FIG. 11.—NEW ENGLAND MILK AND CREAM TRAFFIC BY RAILROADS, JUNE, 1925

June is the month of relatively greater cream than milk shipments. (Prepared from data compiled and furnished by W. H. Bronson of the New England Milk Producers Association.)

To illustrate one of the changes which the new rates for New England have brought about in the western Vermont producing area: Point X, for example, a heavy milk-shipping station on the Rutland Railroad, ships to both New York City and to Boston. It is located in the twenty-eighth New York City zone and the tenth Boston

zone. The distance from this point to New York City is approximately 275 miles and to Boston 190 miles. The New York City carlot rate per 40-quart can from this point is 45 cents; the old rate to Boston was 35 cents, and the new rate is 39 cents. This new rate

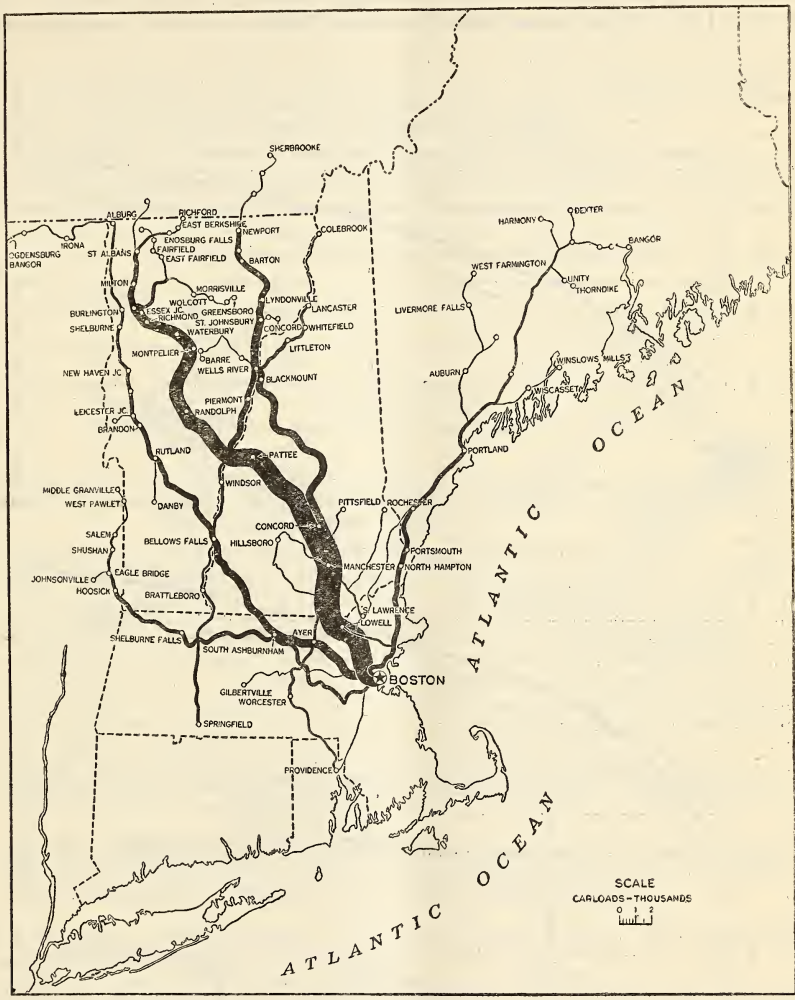

FIG. 12.—NEW ENGLAND MILK AND CREAM TRAFFIC BY RAILROADS, SEPTEMBER, 1925

September is the month of relatively greater milk than cream shipments. Although production is lighter than in June, the main channel is wider. Milk occupies about ten times as much car space as does its equivalent in cream. (Prepared from data compiled and furnished by W. H. Bronson of the New England Milk Producers Association.)

to Boston is 5 to 6 cents per hundredweight of milk in car lots higher than was the old rate. That is, the New York City shipper has now a rate differential of 5 to 6 cents per hundredweight in his favor, as compared with the conditions existing prior to the recent New England rate change.

Even during normal years, the New England supply of fluid milk and cream is scarce during the late summer and early fall months. This is true also of the supply in the New York City milk shed. Development of milk production in the Lake Champlain area, particularly on the eastern side, has been marked during the last few years. It is in this area that the New York City and metropolitan

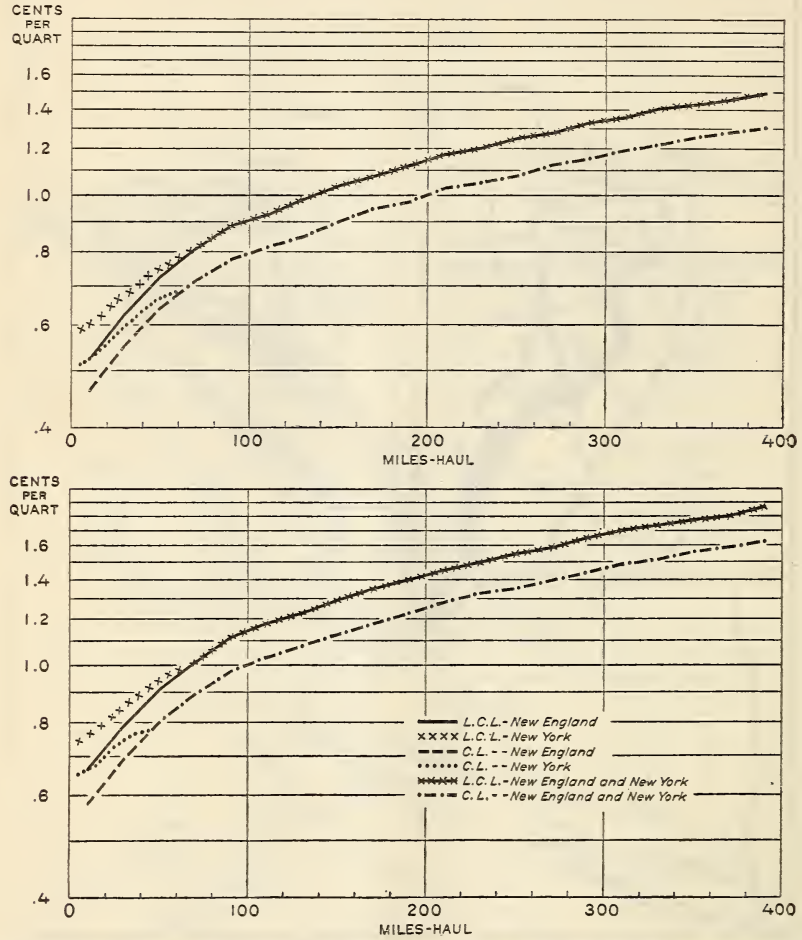

FIG. 13.—RAILROAD RATES ON MILK AND ON CREAM, NEW ENGLAND AND NEW YORK, IN EFFECT JUNE 10, 1927

Since June 10, 1927, freight rates on milk and cream in New England have been essentially those in effect in the New York City milk shed. The upper chart represents milk and the lower chart represents cream.

Boston milk sheds overlap. With the regular seasonal milk scarcity, the eastern Lake Champlain area will become, to a still greater extent, the meeting ground of competition in milk buying. Milk prices in this area will be governed not by either of the two markets mentioned, but by a blend of the economic forces existing in both markets. The recent increase in New England milk freight rates

will accentuate the competition in the area, and this increased competition will make itself felt in higher prices.

The Rutland Railroad did not increase its intrastate freight rates, whereas the other New England railroads increased rates for short hauls 20 per cent. Some milk plants along the roads which increased these rates will find it advantageous, therefore, to ship milk direct to one of the large markets rather than to neighboring condenseries. Thus competition between the condenseries will be stimulated, and they will probably find it necessary to pay higher prices for milk in order to maintain their needed volumes of supply.

The effect of seasonal fluid-milk supply shortages, coupled with changes in freight rates, will be to shift the weight of price-making forces in the direction of the western Vermont milk area. The result

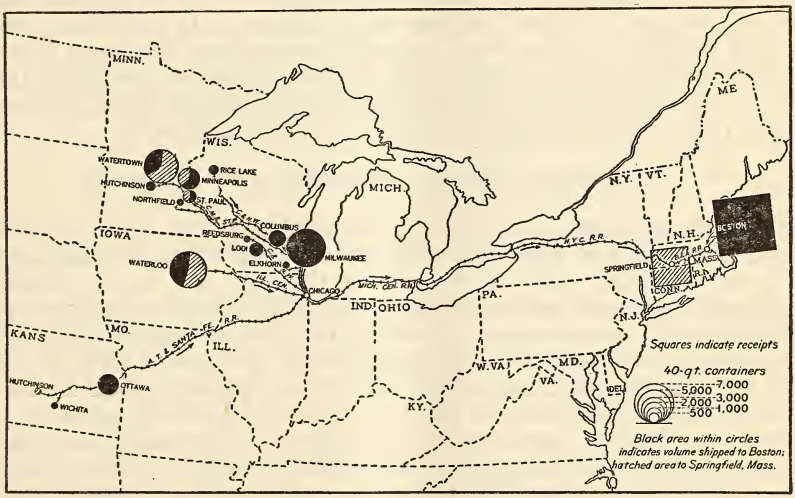

FIG. 14.—FRESH CREAM SHIPMENTS TO BOSTON AND SPRINGFIELD, MASS., FROM CENTRAL STATES BY FAST PASSENGER TRAIN, NOVEMBER 4, 1926-APRIL 24, 1927

As New England's milk supply is needed more and more for fluid-milk consumption, its markets must look to Canada or to the Middle West, or to both, for its table cream. During the last two years increasing quantities of cream have come from the Middle West. (Source of data: Boston & Albany Railroad.)

will probably be a generally higher producer-price level throughout the entire New England milk shed.

Another effect of the 20 per cent approximate increase in rates for zones 1 to 4 will be the transportation of a greater volume of milk and cream by auto truck where road conditions, both winter and summer, permit.

During 1925 and 1926, fresh table cream moved in express car lots, of two hundred 40-quart cans each, by fastest passenger-train service from points in Kansas, Iowa, Minnesota, Wisconsin, and Michigan to Springfield and Boston, Mass. (Fig. 14.) The maximum distance thus hauled was 1,700 miles, but most of the cream was hauled about 1,400 miles. The running time of these passenger trains from middle western points to the Massachusetts markets ranged from 30 to 40 hours, including time spent in switching in Chicago. The

actual running time from the farthermost points in the Canada-Boston cream shed and from middle-western sources of Boston's supply was practically the same. The rates per 40-quart can ranged from $1.85 to $2.28½, including return of empty containers. The western cream arrived in excellent condition.

From an analysis of the situation with reference to fresh-cream shipments to New England markets from the Middle West, it appears that these shipments are increasing each year; that the season is confined essentially to the cool-temperature months; and that shipments are the direct result of seasonal cream shortages in New England brought on by the greater diversion of New England milk from cream to fluid-milk market channels. Under the new freight-rate schedules for New England, the middle-western shipper has a freight advantage amounting to 4 cents per 40-quart can, or $8 per car over the farthermost Vermont car-lot cream shipper. It has been found entirely possible to ship sweet, palatable cream long distances if it is properly handled from producer to market. Cheaper feed and other lower costs of producing cream in the Middle West offset, to some extent, high freight charges on cream to New England.

POTENTIALITIES OF TANK-CAR SHIPMENT

The tank-car shipment of milk in New England has been confined, during the last few years, to a single car. In other sections, such as those supplying milk to the city of Chicago, the use of modern milk tank cars dates back to 1922, although their use was not general until two or three years ago. In May, 1927, there were 62 milk tank cars transporting milk into Chicago, 5 into New York City, 2 into New Orleans, 8 into Pittsburgh, and 8 into Philadelphia.

Nearly all milk-tank cars are built alike. Each car, whether of freight, express, or passenger type, contains two steel, glass-lined, cork-insulated, and protective steel-jacketed tanks of 3,000 gallons each, making the total capacity per car 6,000 gallons. On the basis of present New England (car-lot) car loading of two hundred and sixty-nine 40-quart cans (or 10,760 quarts) per car, each modern milk tank car can displace 2.2 standard New England milk cars.

Where modern milk tank cars have found practical use their users express satisfaction with them. Greater economy is claimed because of reduced costs in milk handling and because milk so shipped arrives in better condition if properly handled at the point of origin than does that shipped in standard cars, according to these users.

In the late spring of 1927 the trunk-line railroad committee was requested to grant special rates on milk transported into New York City in modern milk tank cars. Those making the request included the New York Milk Conference Board, representing practically every milk company or association in the metropolitan New York district; companies and associations in Philadelphia, Baltimore, and Syracuse, Buffalo, and Rochester, N. Y., Bridgeport and New Haven Junction, Conn., and other cities; and the New York State department of agriculture and markets.

The milk conference board's proposals were in substance as follows:

(1) That the special tank-car rates should be calculated on the net weight of milk per hundred pounds. In other words, the present less-than-car-lot milk

rates per 40-quart can should be divided by 113 pounds (86 pounds of milk and 27 pounds for weight of can) and the quotient multiplied by 100.

(2) That tank-car rates should be 87½ per cent of the above calculated net-weight milk rates.

(3) That upcountry, fractional-load, pick-up privileges should be accorded users of milk tank cars.

The milk conference board claims that the use of milk tank cars by shippers will be advantageous to trunk-line railroads in the following ways. Tank cars will—

(1) Do away with much less-than-car-lot icing expense to railroads.
(2) Eliminate much upcountry loading expense to railroads.
(3) Reduce much unloading and also reloading expense to railroads in cities.
(4) Reduce and save railroad platform and terminal expense.
(5) Release much rolling stock now used for milk transportation to other freight traffic.
(6) Reduce equipment maintenance expense properly chargeable to milk traffic.
(7) Reduce claims against railroads due to shortage and spillage of milk.
(8) Enable reduction in size of milk-train crews or partial crews.
(9) Reduce operating expense of milk trains or partial milk trains.

New England milk producers and shippers are vitally interested in the outcome of the request of the New York Milk Conference Board. The precedent set by any agreement reached in the New York milk territory could be used as a basis for conference between New England shippers and the New England railroads that haul milk.

As shown in Table 4 there are nine shipping points in Vermont and New Hampshire that have annual volume of milk handled sufficient to ship a tank car of 22,000 to 24,000 quarts daily, providing seasonal plant receipts do not fluctuate too widely, and providing further that there is both upcountry and city consolidation or coordination of shippers and receivers. Under usual tank-car or car-lot shipping rules, car-lot freight rates are granted only when there is a single shipper and a single receiver. In Vermont and New Hampshire there are seven individual milk plants whose annual volumes are sufficient to use tank cars for shipping milk if the single-receiver condition mentioned above can be met.

Sooner or later milk will be shipped in New England on a more economical basis than now obtains. Whether the business enterprise be private or producer cooperative, substantial savings in freight costs will become possible through volume shipping of milk. Under the present milk freight-rate differential of 6 to 8 cents per 100 pounds between less-than-car-lot and car-lot rates, the shipper will effect substantial savings in freight charges by shipping in car lots if he can buy ice cheaply.[8] These savings can, in part at least, be passed on to the milk producer in the form of higher prices. The higher milk prices should bring about increased deliveries by producers. Thus there is brought about a form of insurance of milk volume delivery to the plant that uses the tank cars. The inefficient competing milk plant is thus placed in a position that makes continued operation improbable.

[8] The car-lot shipper must ice milk cars at his own expense.

FREIGHT RATES AND VOLUMES SHIPPED BY PLANTS

Ninety per cent or more of all milk and cream received at Boston reaches there by rail. "About 50 per cent of the traffic is handled in less-than-carload or 'open' cars, but owing to their lighter loading the less-than-carload cars make up 66 per cent of the total cars operated. The average loading of less-carload cars is one hundred and eighty-six 40-quart cans and 269 cans for carload shipments; the carload minimum is 223 cans."[9] Although the foregoing statement is for New England, it may be taken to apply to milk and cream moving by rail into metropolitan Boston.

Because of the absence of coordination, either among shippers at specific upcountry shipping points or among receivers at terminal receiving stations in metropolitan Boston, or both, much milk and cream that could have moved under car-lot rates now moves under less-than-car-lot rates. There are now many points in New England (fig. 15) where the combined shipments from two or more plants form a carload and are shipped, under an unbroken seal, at less-than-car-lot rates, direct to a definite receiving station in metropolitan Boston. This situation suggests that if these plants were consolidated to take advantage of car-lot rates substantial savings could be effected. Table 4 shows that at 26 Vermont milk and cream shipping points there is sufficient volume for regular daily car-lot milk shipments throughout the year. Furthermore, during the season of heavy milk production, there are a number of additional stations where sufficient quantity is available to ship in car-lot volume.

TABLE 4.—*Milk receipts at 153 Vermont milk and cream shipping stations, 1926*

[Compiled from data furnished by the Vermont department of agriculture]

Milk and 3.7 per cent butterfat milk equivalents received (1,000,000 pounds)	Shipping stations receiving indicated volume of milk or cream [1]	Shipping-point classification
	Number	
0.1 to 9.9	127	Less than daily car-lot milk volume.
10.0 to 19.9	17	Potential daily car-lot milk volume.
20.0 to 50.0	9	Potential daily tank-car milk volume
Total	153	

[1] Includes some stations from which manufactured milk products were shipped as well as milk and cream.

A saving to producers, however, from shipment of more milk in car-lot volume forms only a part of the economies possible through a well-coordinated marketing system. Large savings in plant-handling costs are possible through plant consolidation at shipping points. (Table 5.) There is the further possibility of combining some shipping points by elimination of small receiving stations, with only a slightly longer local haul.

[9] Interstate Commerce Commission, I. and S. Docket No. 2635, Brief on Behalf of Carriers, p. 5.

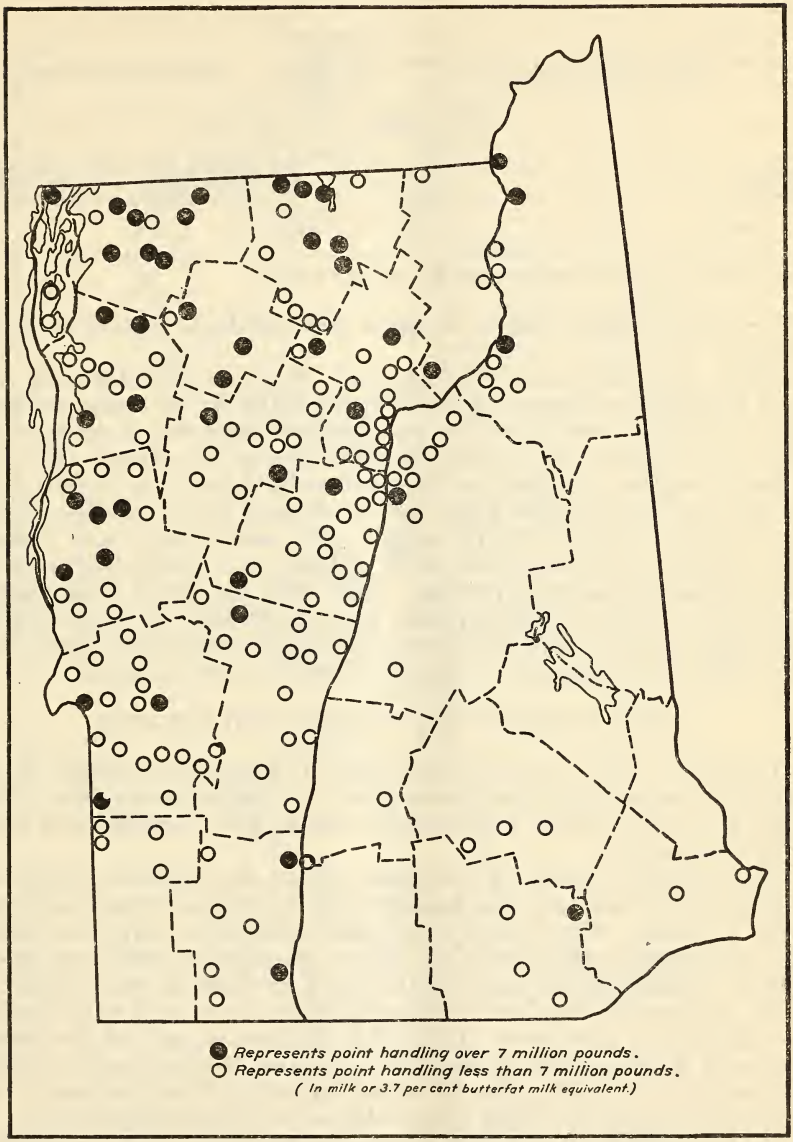

FIG. 15.—NEW HAMPSHIRE AND VERMONT MILK-SHIPPING STATIONS

A number of milk-shipping points in Vermont and New Hampshire have sufficient average daily volume to permit regular daily car-lot shipments, which would make possible substantial savings in freight costs. (Source of data: Vermont and New Hampshire State departments of agriculture.)

TABLE 5.—*Volume of 120 milk and cream shipping plants in Vermont, 1926*

[Compiled from data furnished by the Vermont department of agriculture]

Milk and 3.7 per cent butter-fat milk equivalents shipped (1,000,000 pounds)	Plants shipping indicated volume of milk or cream	Shipping-plant classification
	Number	
0.1–9.9	98	Less than daily car-lot milk volume.
10.0–19.9	15	Potential daily car-lot milk volume.
20.0–40.0	7	Potential daily tank-car milk volume.
Total	[1] 120	

[1] These figures were taken from plants that ship only milk and cream.

In further consideration of plant consolidation, Figure 18 is of interest.

There are some plants which, because of local outlets for milk and milk products, or because of facilities for butter or ice-cream making, may still find it best, from the standpoint of economy in plant operation, to ship milk and cream in less-than-car-lot volume. But the growing tendency in the New England milk industry is to ship milk in fluid or sweet-cream form and to depend upon middle-western or Canadian sources for its supply of cream, butter, and cheese. Since this is true, butter or cheese making, as a milk-plant adjunct will probably disappear in time. This does not apply immediately to butter or cheese making plants that are difficult to reach, but as new highways are built, or existing roads improved, these plants, too, may find it advantageous to ship fluid milk or sweet cream.

AREAS COVERED BY UPCOUNTRY MILK PLANTS

In April, 1927, a survey was made of the areas covered by 26 typical Vermont milk and cream plants. The cross section of Vermont that was covered represented areas of low, medium, and high milk production.

The manager of each of the plants visited was asked to outline on a large-scale road map the area covered by wagon, truck, and rail from his plant. Wagon and truck hauling charges were ascertained for each route. Ownership of trucks or wagons used was ascertained. Note was also made of the types of roads on each route.

In sections of heaviest milk production there was considerable overlapping of plant area. (Fig. 16.) So long as each of the plants secures a daily volume of about 250 or more 40-quart cans of milk, the question of duplication on collection routes is not serious. The subject of economical daily plant volume is discussed elsewhere.

Passableness of roads under adverse weather conditions determines to an appreciable extent the distance reached by each plant. After severe snowstorms, roads may be blocked for several days. A milk plant, however, must have its daily supply of milk delivered promptly.

Cost of hauling, whether by wagon or auto truck, is another area-limiting influence. The compilation of hauling charges on 190 routes (Table 6) should be of use in determining charges to be anticipated

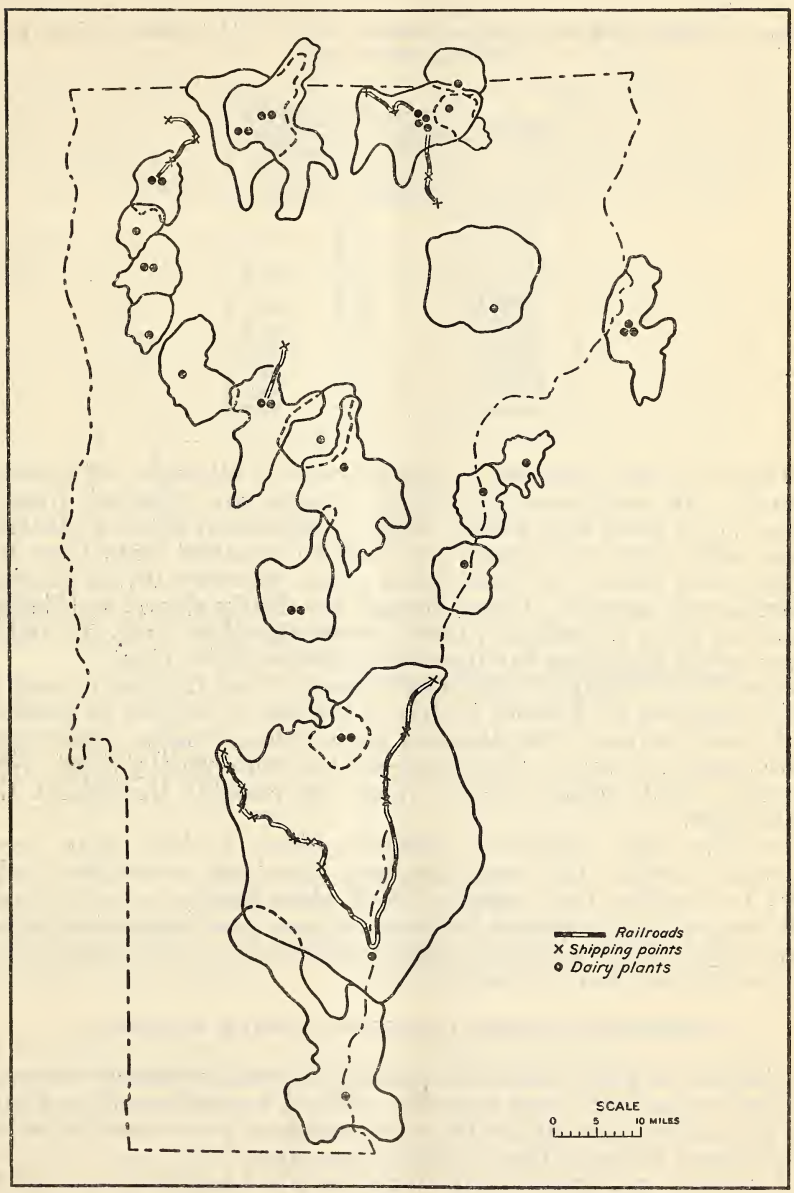

FIG. 16.—MAXIMUM HAULING AREAS FOR MILK AND CREAM COVERED BY WAGON, AUTO TRUCK, AND RAIL OF TYPICAL VERMONT AND NEW HAMPSHIRE DAIRY PLANTS, 1926-27

The area covered by a given plant is determined chiefly by density of milk production, size of plant, competition, condition of roads, and hauling charges.

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when plant operators contemplate area enlargements or route extensions.

TABLE 6.—*Wagon and auto truck milk-haul routes of 10 typical Vermont milk plants, spring, 1927*

Maximum distance	Total routes of length indicated	Average hauling charge per hundredweight
Miles	*Number*	*Cents*
2.0- 2.9	9	17.5
3.0- 3.9	9	
4.0- 4.9	25	
5.0- 7.49	63	21.0
7.5- 9.9	19	
10.0-12.49	22	24.7
12.5-14.99	10	
15.0-19.9	12	28.2
20.0-24.9	6	31.8
25.0-29.9	3	35.5
30.0-34.9	2	39.1
35.0-39.9	4	42.2
40.0-49.9	6	45.2

There is much variation in the methods of allocation of hauling charges. In most cases the hauling charges are deducted directly from f. o. b. plant milk prices. Where competition between plants is keen, milk prices are quoted net, and no apparent deductions for hauling are made. In some cases, plant operators divide hauling charges with patrons. Unless charges are clearly shown, and deductions are made accordingly, those nearest the plant carry an undue share of the aggregate hauling charges of the entire plant.

Most of the hauling routes were between 4 and 12 miles in length. This shortness of distance is due to the use of wagons in summer and sleds in winter. For distances greater than 12 miles, auto trucks were generally used. The truck routes were usually over well-traveled, hard-surfaced roads, which are passable throughout the entire year.

In most cases, wagons or trucks used on hauling routes were privately owned. In a very few cases the plants owned the trucks used for hauling their supply. Both plant managers and patrons felt, as a rule, that contract-basis hauling was most satisfactory to all concerned. Hauling charges could be agreed upon, and responsibility for satisfactory services could be fixed.

ECONOMICAL SIZE FOR COUNTRY MILK STATIONS

That size of plant which will permit the lowest operating costs per unit of output is the most desirable. Only a limited quantity of data on this subject is available but it is enough to give some indication of the lower limits of the desired volume group.

The curve in Figure 17 represents the plant-handling costs of 38 milk and cream receiving stations located in the New England area, chiefly in Vermont, as calculated from schedules obtained by the United States Tariff Commission. These plants are essentially milk and cream receiving and shipping stations but the quantity of cream shipped forms a relatively small part of the total. The costs shown include no transportation expenses but only such costs as occur within

the plant—in connection with receiving, cooling, can filling, and shipping.

The curve of costs represents the average of the various plants as they actually exist. The item of buildings and equipment is not constant for all plants but tends to increase with increased volume. If increased volumes were passed through the plants without a corresponding increase in equipment, declines in per-unit costs with increased volumes would be more marked. For plants handling equal volumes there is a further variation in costs due to differences in efficiency of individual management and economic organization.

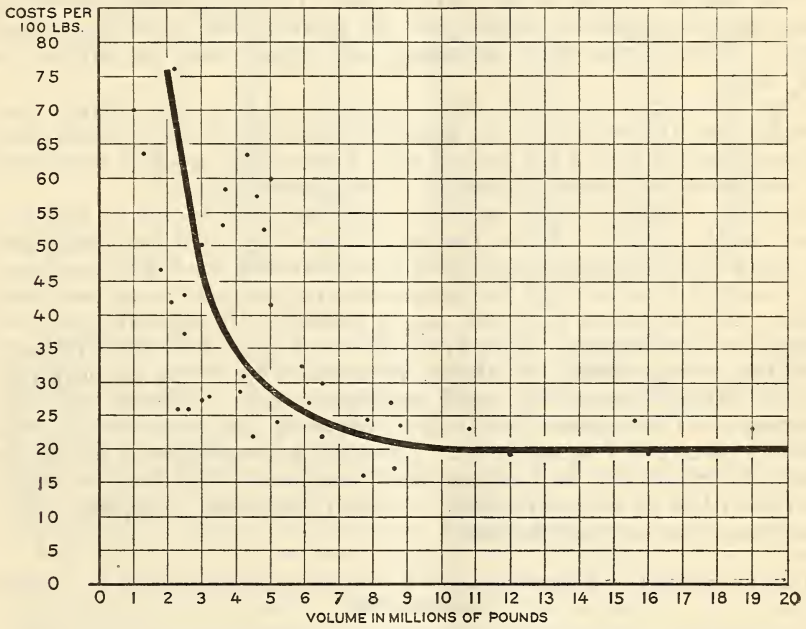

FIG. 17.—RELATION OF DAIRY PLANT-HANDLING COSTS TO VOLUME HANDLED, NEW ENGLAND MILK AREA, 1926

Plants whose annual volume handled is not less than 7,000,000 pounds of milk, or 3.7 per cent butterfat milk equivalent, and whose receipts are fairly uniform throughout the year, usually fall in the low-handling-cost group. (Source of data: United States Tariff Commission.)

The curve indicates that, for economical operation from the standpoint of costs, the annual volume of a plant should be not less than 7,000,000 to 8,000,000 pounds of milk or an average of two hundred and twenty to two hundred and fifty 40-quart cans of milk per day; a higher volume is even more desirable. When the volume is below that point, costs begin to increase rapidly, and when it is below 5,000,000 pounds they rise very rapidly. A plant that ships 7,000,000 pounds of milk per year would be able to ship a carload each day, providing there were no seasonal variation in receipts. However, with the usual seasonal variation found, car-lot shipments would be possible only during the season of heavy production. Consequently, under Vermont conditions, a volume of 10,000,000 or more pounds

would be necessary to maintain car-lot shipments throughout the year. Such a volume would not only bring about a reduction in freight costs but would also make possible further savings in handling costs, with higher returns for the producer.

The greater part of the 98 plants shown in Table 5, which handle less than 10,000,000 pounds, fall into the groups that have high costs for handling. When high costs for handling are coupled with higher freight rates on less-than-car-lot shipments the resulting expense becomes such that one may reasonably expect the plants in the less-than-car-lot shipment group to lose in the competitive struggle.

The number of plants that handle over 11,000,000 pounds on which data were available are rather few for locating the curve above that point. Two of the dots indicating such plant costs are hidden by the curve.

One important cause of the dispersion of costs for plants that handle the same volume is the seasonal character of their production. Those plants to which the flow of milk varies little are able to operate at a substantial saving, especially in equipment costs.

In determining whether sufficient milk can be attracted to supply a plant with a given volume, the cost of hauling must be considered. Prices, after the hauling costs have been deducted, must still be attractive enough to induce the farthest tributary producer to deliver fluid milk. The distance milk has to be hauled will depend upon the density of production. Data available for Vermont for 1925 indicate that the average density of annual production marketed was approximately 107,000 pounds of milk per square mile. (Table 7.) The average for Chittenden County, the county of maximum density, was 253,311 pounds per square mile. These are average figures for all the land in a given area and include many sections of the State in which there is little or no production. Around particular shipping points densities often average higher.

TABLE 7.—*Density of production of milk and milk equivalents sold to Vermont plants, 1925*

County	Area	Total 3.7 per cent milk (or milk equivalents) of 204 plants [1]	Average quantity received per square mile	County	Area	Total 3.7 per cent milk (or milk equivalents) of 204 plants [1]	Average quantity received per square mile
	Square miles	*Pounds*	*Pounds*		*Square miles*	*Pounds*	*Pounds*
Addison	756	98, 610, 181	130, 437	Orange	676	73, 605, 769	108, 884
Bennington	661	12, 226, 852	18, 498	Orleans	688	129, 528, 455	188, 268
Caledonia	618	76, 047, 280	123, 054	Rutland	911	79, 135, 281	86, 866
Chittenden	543	137, 547, 659	253, 311	Washington	719	78, 544, 575	109, 241
Essex	638	13, 666, 315	21, 421	Windham	795	34, 203, 035	43, 023
Franklin	652	125, 789, 201	192, 928	Windsor	948	41, 694, 786	43, 982
Grand Isle	83	20, 171, 131	243, 026				
Lamoille	436	54, 515, 832	125, 036	Total	9, 124	975, 286, 352	106, 892

[1] Data from thirteenth biennial report of the commissioner of agriculture of the State of Vermont, 1924-1926, p. 31.

TABLE 8.—*Country milk station handling costs, including hauling costs to the plant for indicated volumes and densities of production*

Volume handled per plant		Plant-handling cost per hundredweight	Plant-handling costs plus hauling costs for various densities of production			
Annual	Average daily		50,000 pounds (579 40-quart cans) per square mile	100,000 pounds (1,157 40-quart cans) per square mile	150,000 pounds (1,736 40-quart cans) per square mile	200,000 pounds (2,315 40-quart cans) per square mile
1,000,000 pounds	*40-quart cans*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1	32	103.1	120.2	119.6	119.4	119.3
2	63	75.1	93.1	92.3	91.9	91.7
3	95	45.7	64.2	62.3	62.9	61.6
4	127	34.3	53.3	52.3	51.8	51.5
5	159	29.4	48.9	47.7	47.1	46.8
6	190	25.3	45.2	43.8	43.3	42.9
7	222	23.6	43.8	42.4	41.8	41.4
8	254	21.4	42.0	40.4	39.4	39.4
9	285	20.7	41.6	40.0	39.2	38.1
10	317	20.0	41.2	39.5	38.7	38.3
11	349	20.0	41.5	39.7	38.9	38.4
12	381	20.0	41.7	39.9	39.0	38.5
13	412	20.0	42.0	40.0	39.2	38.7
14	444	20.0	42.3	40.2	39.3	38.8
15	476	20.0	42.5	40.4	39.5	38.9
16	517	20.0				

Assuming that supplies could be obtained in all directions around a shipping point, combined unit costs for hauling and handling through the plant were calculated for plants requiring 1,000,000 to 16,000,000 pounds volume to be drawn from territory of four assumed degrees of density. (Table 8.) A hauling distance equal to the radius necessary to supply the various indicated volumes was assumed. The hauling costs included are computed on the basis of costs secured from 10 plants and shown in Figure 18.

Any density could be assumed and costs calculated on that basis, but for illustration four densities within the range of Vermont production have been taken. For the conditions assumed, the data indicate that the minimum cost per unit of product is reached at an annual volume of about 10,000,000 pounds. At greater volumes, plant costs per unit of product do not increase but either remain constant or decline. However, because milk must be hauled farther (thereby increasing the hauling costs) the combined hauling and plant costs increase, although the rate of increase is not very rapid.

In spite of the gradual increase in cost of hauling as distance increases it may often be desirable to reach out farther to secure the supply needed for a larger volume. On the basis of cost, the operation of two plants independently at the time or at neighboring points can not be justified unless each has a sufficient volume to insure lower hauling and handling costs than would result for a single plant with a longer haul.

THE PRODUCER AND MILK PRICES

RETAIL-DELIVERED MILK AND STORE SALES

In a few of the New England cities bottled milk is being sold by licensed stores at a price which leaves no margin of profit to them and which occasionally results in actual loss. A subprofit price level

is a decided factor in creating instability in the entire milk industry. Uneven retail milk prices demoralize the retail trade and bring cut-throat competition in the retail, jobbing, and wholesale branches. This in turn discourages milk production. Carrying the process still farther, decreased production is followed by higher upcountry milk prices, which in turn induce higher wholesale and retail prices. In the end, the consuming public will not be properly served, nor will the milk producers be adequately rewarded for their efforts. Milk, considered in the light of a public necessity, must have neither its production nor its consumption affected adversely, lest the public welfare be menaced.

Prior to the fall of 1921 some of the food stores of metropolitan Boston, particularly those operated by several of the large milk dealers, sold milk and cream. But the volume thus handled was

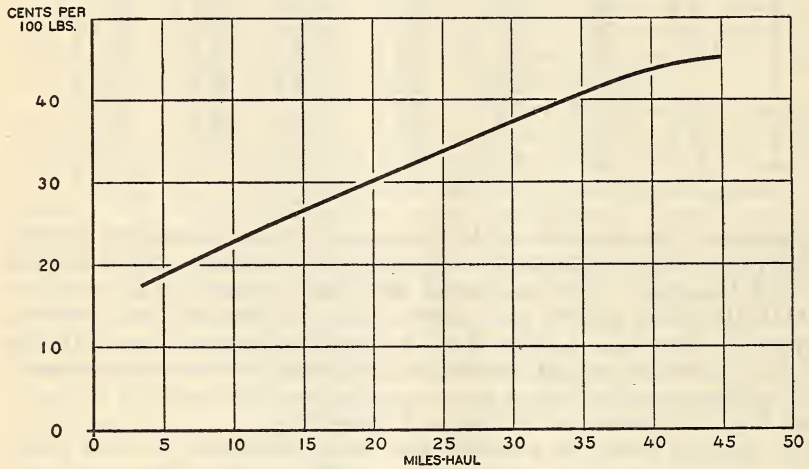

FIG. 18.—MILK-HAULING CHARGES OF 10 VERMONT PLANTS FOR APRIL, 1927

Hauling charges for milk (which includes the return of empty containers) are determined chiefly by distance hauled. Distance hauled depends largely upon density of milk production, and passableness and kind of roads. Good roads are the main factor.

relatively small when compared with that delivered on the wagon routes of the several hundred licensed milk dealers. Because retail prices were the same for wagon-delivered and for store milk, there was little inducement for people to buy their regular supply of milk and cream at stores.[10]

In 1922 one of the store systems which was licensed to handle milk offered bottled milk as a "leader" at 10 cents a quart, "cash and carry." This was 3½ cents under the delivered price. (Fig. 19.) In

[10] H. A. Ross, in his description of the marketing of milk in Chicago, has this to say about the handling of milk by grocery stores: "The corner grocery serves as a convenient milk depot to which the housewife can send for an extra bottle of milk to supplement the regular daily delivery. In addition, many families lacking ice in the summer depend on stores for the purchase of milk in small amounts just before it is to be consumed. The stores also get a large part of the trade of construction workers and similar groups of laborers, among whom there has been a great increase in the use of milk since the passing of the beer pail, although large quantities are also purchased directly from retail wagons which make deliveries during the lunch hour." Ross, H. A., "The marketing of milk in the Chicago dairy district," Ill. Agr. Exp. Sta. Bul. No. 269, 1925.

order to hold their trade, other store systems, although they had not carried milk before, offered bottled milk at the same price and under the same conditions.

This sudden advent of several hundred licensed stores in the retail milk business forced each dealer with wagon routes to a lower delivered retail-price level. Table 9 shows the comparative price changes for retail-delivered and store milk, 1922 to 1927. The difference in June, 1927, was 2 cents per quart of bottled milk. The margin between wagon-delivered and licensed-store milk in other

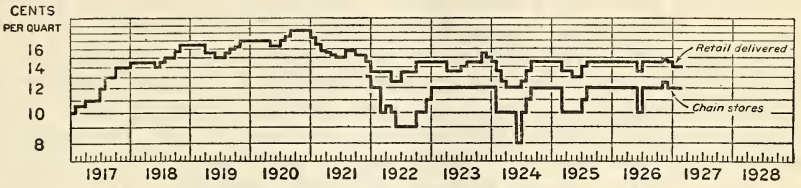

FIG. 19.—RETAIL MILK PRICES IN BOSTON

The price spread between delivered and store milk, although erratic during the first few years, has lately shown a tendency to become stabilized at 2 cents.

cities along the Atlantic seaboard at that time ranged between 1 and 4 cents, mostly 2 cents, per quart.[11] In Baltimore, store milk sold for 1 cent more per quart bottle than did delivered milk.

TABLE 9.—*Average price differential between retail-delivered and store milk, 1922–1927*

Year	Price differential per quart bottle	Year	Price differential per quart bottle
	Cents		*Cents*
1922	3.4	1925	2.8
1923	2.3	1926	2.5
1924	2.8	1927 [1]	2.0

[1] First 6 months of year.

A general analysis of the situation in metropolitan Boston in June, 1927, indicated that licensed stores handled approximately 12 per cent of the retail milk volume at prices 2 cents lower than the delivered milk. There seems little likelihood that this proportion will increase unless the price differential becomes greater. The wagon-delivery dealers will exert every selling effort to prevent an increased price differential.

Milk as a store "price leader" lost much of its customer-drawing power in 1926.[12] Retail stores must constantly seek different staple wares, attractively priced, to draw and hold their customers. The rapidly increasing keen competition between stores makes this seem imperative.

The advent in metropolitan Boston of licensed milk-handling retail stores—aside from creating a passing price instability—has been instrumental in hastening the introduction of more efficient business practices in the retail wagon delivery and in the wholesale

[11] According to data obtained from the New England Milk Producers Association.
[12] According to information obtained by department representatives from officials of stores licensed to handle milk and from other agencies.

trade. Wagon-delivery dealers lost some of their customers to the licensed milk-handling stores. This resulted in fewer customers per wagon route. Margins of returns were reduced to the extent that overhead and fixed-charge expenses had to be prorated over fewer quarts delivered.

But in many of the sections of metropolitan Boston most of the customers wanted their daily milk supply delivered regularly and promptly. The saving of 2 cents per quart of milk was not sufficient inducement to go to milk-handling stores during limited hours and days for their daily milk needs. This class of customers had to be served. Some retail wagon dealers met the loss of customers by selling out to other dealers already in business or by consolidating their interests with other dealers similarly situated, thereby effectively reducing overhead and fixed expenses per unit of milk sold. The merging or consolidation of business units (which were too small to meet competition because of high costs) with other like businesses into larger units permits greater operating economy. It is a forward step from an uncoordinated, haphazard, and multiple type of business to a more efficient, coordinated, and stabilized industry. Competition between the larger units can then be on the basis of operating efficiency and service rendered as well as on the basis of price.

Table 10 is significant in that it brings out the point that, although population of the cities included has increased, the number of licensed milk dealers has decreased. This indicates a decreased number of competitive wagon-dealer units but not necessarily less keen competition. Early in 1927 several fairly large milk distributors merged their interests into a single organization. Less than five wagon-dealer milk-distributing companies now handled 74 per cent of the daily fluid-milk receipts of metropolitan Boston. There are indications that further consolidations will take place within the near future—a process not unwholesome to the industry unless carried to the point of monopoly.

TABLE 10.—*Ratio of licensed dealers and licensed stores to families in four cities or city groups, 1920 and 1925*

Year and city or city group	Population	Number of families	Number of licensed dealers	Ratio of dealers to families	Number of licensed stores	Ratio of stores to families
1920						
Boston, Brookline, Cambridge, and Somerville, Mass.	[1] 988, 593	[1] 221, 334	[2] 282	1:785	[3] 5, 533	1:40
1925						
Boston, Brookline, Cambridge, and Somerville, Mass.	[3] 1, 114, 831	[4] 249, 383	[2] 273	1:913	[3] 8, 019	1:31. 1
Chicago, Ill. [5]	[6] 2, 880, 000	[7] 665, 127	352	1:1889		
Baltimore, Md. [5]	[9] 796, 292	[10] 180, 968	[11] 21	1:8618	[11] 5, 351	1:33. 8

[1] United States census, 1920, Vol. III.
[2] Department of Health, reports for 1920 and 1925.
[3] Massachusetts State census, 1925.
[4] Based on United States census, 1920, "Size of Families" statistics, and the Massachusetts State census, 1925, population statistics.
[5] "Ross, H. A., "The marketing of milk in the Chicago dairy district," p. 465: Ill. Agr. Ex. Sta. Bul. No. 269.
[6] Estimated on United States census data.
[7] Based on estimate for 1923 population and "Size of families" United States census, 1920.
[8] Maryland State Dairymen's Association.
[9] Estimate, Bureau of the Census.
[10] Based on United States census, 1920, "Size of families" statistics, and estimate, Bureau of the Census, 1927.
[11] Maryland State Dairymen's Association.

During the period 1920 to 1925 there was a rapid increase in the number of stores that were licensed to handle milk. Since the population has not increased to the same extent as has the number of licensed stores, the potential number of families that can be served by the average store has become materially less. From this it may be reasoned that each store's overhead and fixed charges represent an increased proportion of selling costs. With reasonable retail-price spreads maintained between delivered and store milk, and with more efficient methods in use on the part of wagon-delivery dealers, it is doubtful whether licensed stores that handle milk will in the future sell an increasing proportion of the total volume of milk that is handled in metropolitan Boston.

One of the chief influences upon a greater per capita consumption of milk during recent years has been the educational activities of the New England Dairy Council, an organization for promoting the consumption of dairy products. Keen competition between the several types of agencies that sell milk at retail has had some influence (Table 11) and so has advertising.

TABLE 11.—*Average daily per capita consumption of fluid milk in eight representative cities, 1920–1926 (pounds per capita per day)*

Year	Boston [1]	New York [2]	Philadelphia [3]	Pittsburgh [4]	Milwaukee [5]	Minneapolis [6]	Baltimore [7]	Richmond [8]
1920	0.58	0.70	0.67	0.48	----	----	----	----
1921	.58	.72	.71	.51	----	0.73	----	----
1922	.60	.74	.74	.53	0.82	.79	----	0.40
1923	.61	.77	.80	.57	.87	.79	----	.42
1924	.63	.78	.77	.57	.87	.81	0.49	.43
1925	.65	.80	----	----	----	.85	.54	.43
1926	.67	.80	----	----	----	----	.58	.43

[1] Based on train and estimated truck receipts for metropolitan district.
[2] New York metropolitan district. Based on total receipts from New York Milk Reporter.
[3] Based on receipt data of Interstate Dairy Council.
[4] Based on actual sales reported by The Dairymen's Cooperative Sales Co.
[5] Actual sales of fluid milk reported monthly by all important dealers.
[6] Actual sales of fluid milk by all dealers; compiled by city health officer.
[7] Actual sales of fluid milk reported by dealers to the Maryland State Dairymen's Association representing 95 per cent of total.
[8] Actual sales of fluid milk as reported by dealers.

RELATION OF RETAIL PRICES TO CONSUMPTION

Changes in retail prices of most commodities usually cause marked changes in the quantity consumed. Dairy products constitute one of the outstanding exceptions to this rule, and this is particularly true of fluid milk. The only complete studies on this point are those which have been made for the Chicago and New York markets.[13] These studies show that season, holidays, temperature, and other noneconomic factors have much more effect upon the quantity of milk purchased by consumers than do changes in price, except when price changes are excessive. At Chicago, increases of 1 cent in the price of milk in quarts reduced consumption by about 1½ per cent, and decreases of 1 cent in the quart prices increased consumption from 0.5 to 2 per cent. No similar detailed study has been made for

[13] Ross, H. A., "The marketing of milk in the Chicago dairy district." Ill. Agr. Expt. Sta. Bul. No. 269, pp. 494–510, 1925.

Boston, but such information as is available[14] indicates that price changes have no greater effect upon consumption there than in other cities.

Retail prices of milk have some effect upon consumption, but the effect is so slight that a surplus of milk can not be disposed of by reducing prices a moderate amount as can the surpluses of most other agricultural products. Since changes in consumption can not be depended upon to help in adjusting supplies and prices to demand, special means must be provided for handling fluid milk. Before discussing the significance of this fact in establishing price policies, the relation of prices to production will be considered.

INFLUENCE OF PRODUCER PRICES UPON MILK SUPPLY

During 1926 and 1927 a study of the effect of producer prices on milk production was made by the Bureau of Agricultural Economics in collaboration with the University of Vermont. Records of patron milk and cream deliveries, prices paid to producers, feed costs, and other pertinent data, were analyzed. The deductions are of significance to those who are interested in maintaining an adequate milk supply and in avoiding milk surpluses.

The results of this study are not presented here as final conclusions but rather as an indication of what subsequent studies of this type may be expected to reveal. More complete and more detailed studies may be expected to show more precisely the effects of the important factors influencing milk production.

It is largely through the effect upon producers that changes in milk prices bring about changes in production. Many farmers may not keep as exact a record of their receipts and expenses as do city business men, but they usually know rather certainly whether they are making money or losing money. Because of the very nature of farming it is not possible to make rapid changes in production, yet within certain limits farmers do increase or decrease production to a considerable extent when prices move up or down.

WAYS IN WHICH PRODUCTION CAN BE CHANGED

The quantity of milk produced in any given area varies with the number of farmers who produce it, the number of cows kept by each farmer, and the average production per cow during the period considered.

The extent to which the volume of production from a given area may change, even within a relatively few years, is illustrated by Figure 20, which shows for 10 years the quantity of milk and cream (in terms of milk) delivered to all Vermont dairy plants each month. In addition to the seasonal movement throughout the year, there was a striking increase during the years 1918 to 1921, a slight pause at the crest in 1923 and 1924, and some slackening in 1925.

Exact data are not available to show whether this increase was due to changes in the number of producers or in the number of cows per producer. Some information can be obtained, however, by selecting given groups of producers and studying changes in their produc-

[14] See footnote 7.

tion, thus eliminating the effect of changes in the number of producers. Such a comparison may be obtained from Figure 21, which shows, by years, changes in the Vermont production and shows changes in production by selected groups at four specific points.

Each of these small groups represents exactly the same producers each year of the series, so only changes in the average number of cows kept by each producer or in the average production per cow are involved. The changes in production have been marked for each of the groups shown. Both at Richmond, Vt., and at Bedford, Mass.,[15] there was a striking increase in average production per producer for the period from 1918 to 1922, though the increase was not quite so marked as it was for the Vermont total. Average production in each

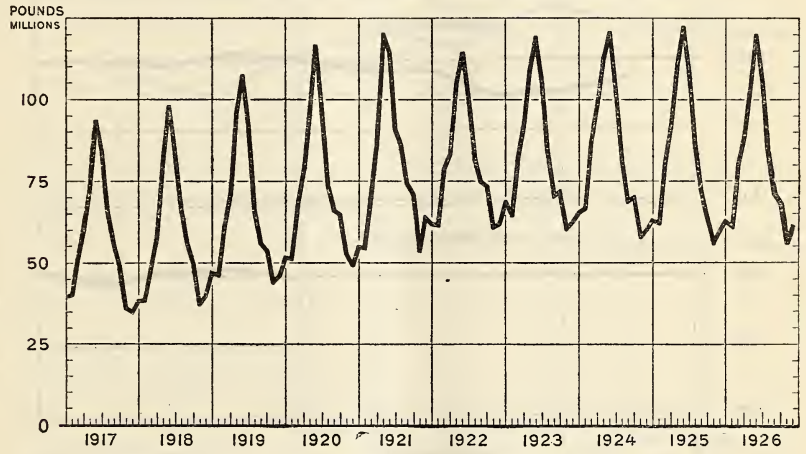

FIG. 20.—MILK AND CREAM DELIVERED TO VERMONT PLANTS

Total milk and cream (converted to 3.7 per cent milk) deliveries to all Vermont plants increased strikingly during the years 1918 to 1921, paused at the crest in 1923 and 1924, and slackened somewhat in 1925. (Data obtained from Vermont State Department of Agriculture.)

group reached a peak in 1922, or 1923, or 1924, and with a single exception there was a noticeable falling off in 1925.

Eliminating the pasture season, as partly influenced by weather conditions, production during the barn season showed similar changes even more strikingly during the same period. (Fig. 22.) It is apparent that influences were at work which tended to cause somewhat the same type of change at each of these points, and that, in addition, there were local causes which made minor differences in the extent of change.

RELATION OF PRICE TO PRODUCTION

Price would be expected to be one of the major factors affecting production. Figure 23 shows that milk prices were rising from 1918 to 1920, during the period when production was also rising, but that prices fell sharply from 1920 to 1922, whereas production

[15] Monthly deliveries of milk and cream and the amount received were obtained for 26 producers from 1916 to 1926 at Bedford, Mass., and for 53 producers from 1916 to 1926 at Richmond, Vt.

continued to increase during the same period. Apparently milk prices, taken by themselves, are insufficient to explain the changes in production.

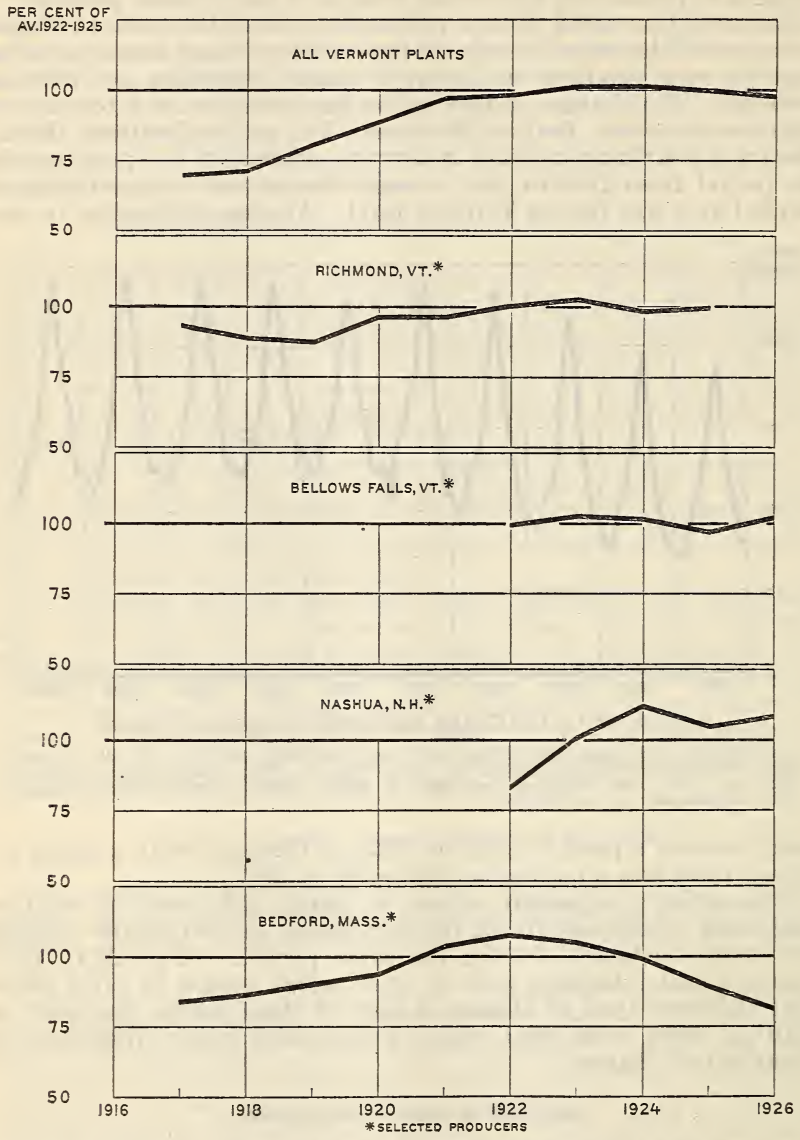

FIG. 21.—ANNUAL TOTALS OF MILK (OR BUTTERFAT) SOLD PER PATRON

Average production for Vermont and for each group of producers shown reached a peak in 1922, 1923, or 1924, and, with a single exception, there was a falling off in 1925.

Returns to dairy farmers depend not only upon what they receive for their milk, but upon the expenses which they have to meet in producing it. Chief of these expenses, particularly on New England

farms where but little grain is raised, is that for mill feeds, including bran, middlings, cottonseed meal, and mixed feeds. Changes in the

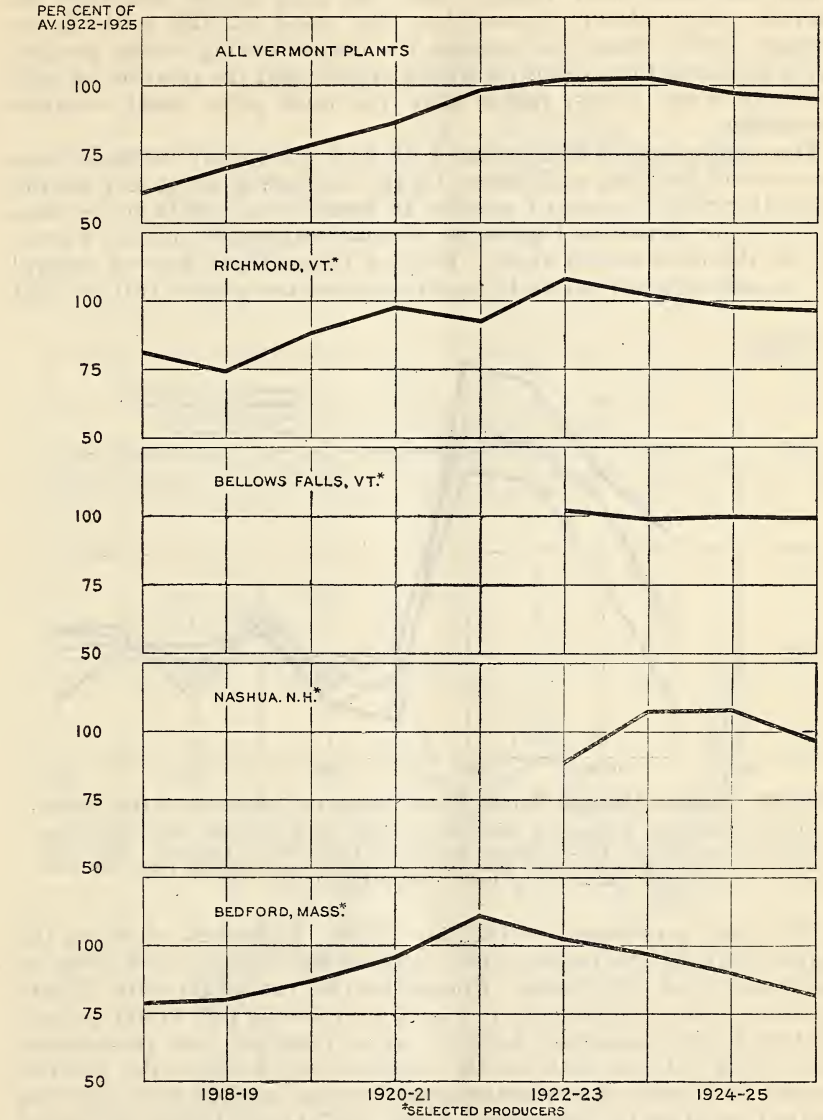

FIG. 22.—VOLUME OF MILK (OR BUTTERFAT) SOLD PER PATRON, WINTER PERIOD TOTALS, OCTOBER TO MARCH, INCLUSIVE

Eliminating the pasture season, as partly influenced by weather conditions, production showed even more strikingly the changes referred to in Figure 21.

prices of these feeds during the above period are shown in Figure 23 by the index of prices of dairy feeds.[16]

[16] The index used here is that prepared by Warren and Pearson and published monthly in the Cornell periodical publication, Farm Economics. Although based on feed at Utica in car lots it is more representative of New England conditions than is any other available series.

Comparisons of feed prices with milk prices show that the two went up at about the same rate from 1918 to 1920, but that then feed prices fell much more rapidly than did milk prices, and they remained comparatively lower than did most of the milk prices through 1923. Since this covered the period during which production was increasing rapidly, it would appear that the relation of milk prices to other prices, rather than the milk price itself, controls production.

The comparison of milk prices with feed prices may be made more accurate by dividing milk prices by the feed-price index and stating the milk price in terms of relation to feed prices. Milk prices thus adjusted are shown in Figure 24, as yearly averages, and in Figure 25, for the barn season alone. Both of these charts show a general rise in milk prices relative to feed costs over the period 1916 to 1921

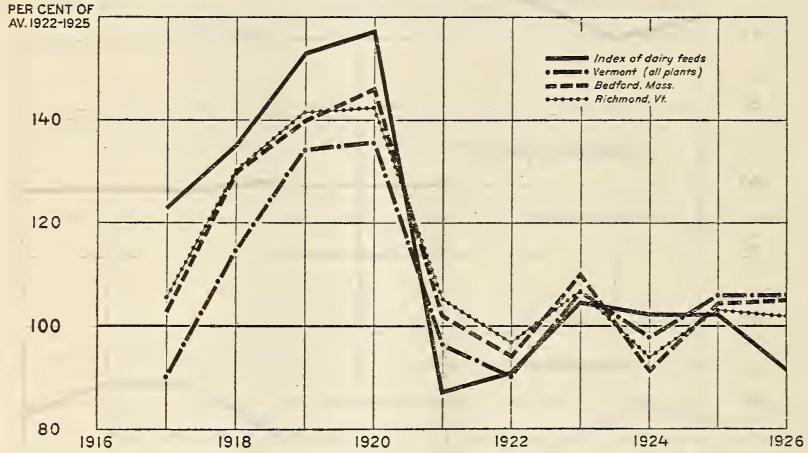

FIG. 23.—ANNUAL AVERAGE PRICES PAID PRODUCERS FOR MILK OR BUTTERFAT

Both prices and production were rising from 1918 to 1920, but prices fell sharply from 1920 to 1922, whereas production continued to increase. This may be explained partly by the fact that feed prices fell more rapidly than did milk prices and remained comparatively lower than during 1923.

or 1922, and a recession in 1923 and 1924. Figure 25, showing the relation during the period when most of the feed is used, may be considered most significant. Comparison of this chart with Figure 22, which shows the changes in production during the winter period, illustrates the connection between price relations and production. Thus, from 1917 to 1921, an all-Vermont record shows the greatest increase in volume of production and the most marked gain in prices received, relative to feed costs. From 1917 to 1920 both Richmond and Bedford show almost the same gain in prices; and from 1916 to 1920 they show almost the same gain in production per producer. There was a sharp reduction in price-feed ratios in 1924, and all three localities showed marked decreases in production the following winter. In the main there appears to be considerable agreement between changes in the relation of milk prices to feed costs and in milk production.

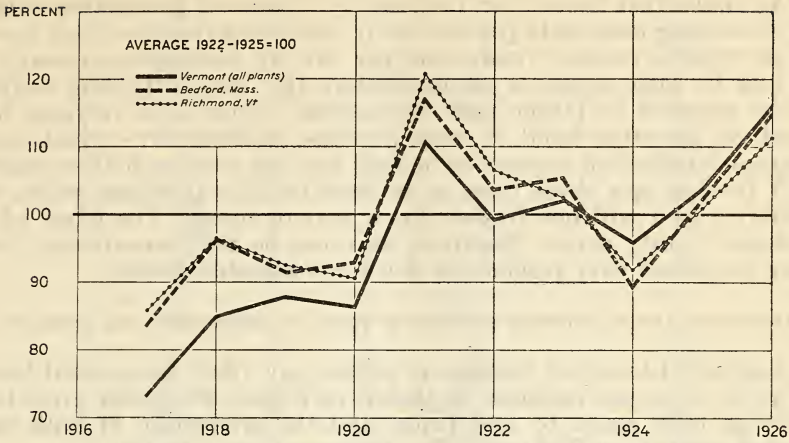

FIG. 24.—ANNUAL AVERAGE PRICES PAID PRODUCERS FOR MILK (OR BUTTERFAT) RELATIVE TO INDEX OF FEED PRICES

This figure shows the prices which farmers received for milk, divided by the index of feed cost for the same year. There was a general rise in milk prices relative to feed costs from 1916 to 1921, and a general decline during 1922 to 1924, with rapid recovery from 1924 to 1926.

FIG. 25.—AVERAGE ANNUAL WINTER PRICES PAID PRODUCERS FOR MILK (OR BUTTERFAT) RELATIVE TO INDEX OF FEED PRICES

The general tendencies shown in Figure 24 are borne out by the data when they are limited to the winter period, October to March, inclusive.

An individual farmer can increase his volume of production either by producing more milk per cow or by increasing the size of his herd. If he tries to increase production per cow by feeding more heavily, it may be some weeks or months before the heavier feeding begins to be reflected in larger milk production. Should he increase his herd, on the other hand, he may purchase milking cows which will increase production at once, or he may buy dry cows or heifers which will freshen in a short time, or he may raise or purchase calves or heifers which will not freshen for a year or more. The effect of a change in milk prices, therefore, may not be felt immediately, but may be spread over production for a considerable period.

LONG-TIME AND SHORT-TIME EFFECTS OF PRICE ON PRODUCTION PER PRODUCER

The extent to which changes in prices may affect the general level of production per producer is shown in Figure 26, which gives the ratio of milk prices to feed prices and the production of milk per patron monthly at Richmond, Vt., for more than a decade.[17]

Periods of markedly advancing prices relative to feeds, as found in the early parts of 1916, 1918, 1920, and 1921, were followed a year or two later by corresponding changes in production, as in 1917, 1920, and 1922. Similarly, periods of low prices, as in 1917 and 1923, were followed by reduced production from one to two years later, as in late 1918 and 1924.

These delayed upward and downward swings of production were apparently due to changes in the number of cows. During periods when milk prices were relatively high farmers would be encouraged to retain calves and heifers in their herds rather than to sell them. A year or two later these animals would freshen and would increase production.

Careful statistical studies of this response by farmers in these three localities all agree in showing that this long-time effect of prices upon milk production is much more marked than is the immediate effect through increased production per cow. For the Richmond records of production per producer, shown in Figure 26, a 10 per cent increase in the ratio of milk prices to feed prices during one year was followed by an increase of about 7 per cent in milk production by the end of the next year. This increase took place during the winter period, but some tendency to increase production was evident during the 12 months following.[18] At Bedford, Mass., on the other hand, a 10 per cent increase in the ratio of milk prices to feed prices over 12 months was reflected in an average increase of 9 per cent in milk production by the end of the succeeding 12 months, whether summer or winter.

The fact that the large increase in production per patron followed so much sooner after a change in price at Bedford, Mass., than at Richmond, Vt., would seem to be due to the difference in the types of dairying in the two sections. Near metropolitan Boston, few

[17] To prevent the relations from being obscured by the wide seasonal swings, the normal seasonal variation has been removed by expressing each series as a percentage of the average for each month separately.

[18] These statements as to production at Richmond, Vt., as well as the data for that point, are taken from a study made by A. R. Gans under the direction of H. P. Young. A report on this study is filed in the library of the University of Vermont under the title "Factors Affecting Average Deliveries of Milk per Patron at Vermont Plants."

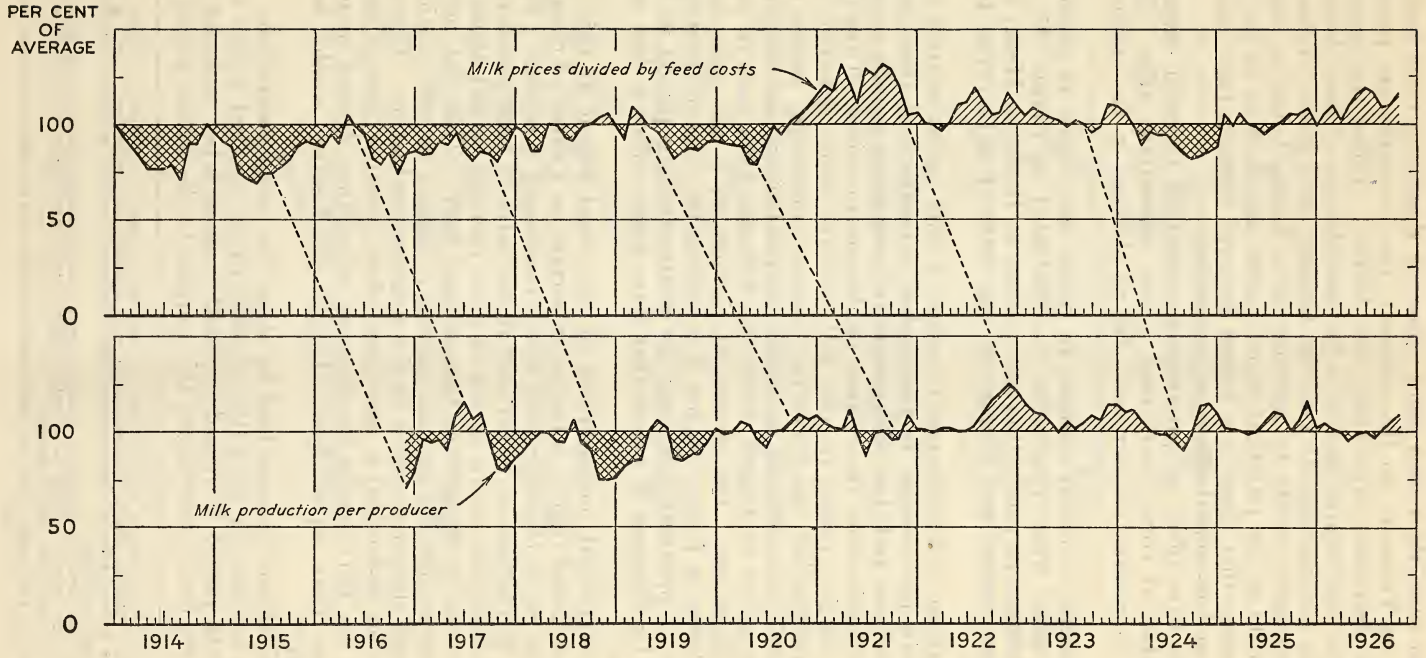

FIG. 26.—MILK, PRICES AND PRODUCTION PER PRODUCER AT RICHMOND, VT.

Periods of markedly advancing prices relative to feeds were followed a year or two later by corresponding changes in production. Both series are expressed in percentages of each month's average for the period.

dairymen raise their own stock; most of them buy their cows elsewhere. In Vermont, on the contrary, but few cows are purchased, for most dairymen raise their own heifers. When the farmers in the Massachusetts area decide to increase the size of their herds they can make the increase at once by buying more cows. When Vermont dairymen decide to increase their herds, however, they are likely to do so by retaining more calves and heifers to be raised, which means that there is a longer interval between the decision to increase and its actual effect on production.

Besides this effect on production, operating through changes in the number of cows, there may be an immediate effect through changes in production per cow, due to changes in the intensity of feeding.

The extent to which changes in prices may have an almost immediate effect upon production is illustrated in Figure 27, which shows changes in production per patron at Bedford, Mass., during the winter period, and changes in the ratio of milk prices to feed prices.[19]

Comparison of the changes in ratios of milk prices relative to feed prices with the changes in production indicates that there is some correspondence and that the changes in production usually occur two to three months after the respective changes in prices. Thus the declining relative prices in the fall of 1916 were reflected in declining production the following winter; advancing prices in the fall of 1920 were reflected in advancing production that winter; and a peak in prices in August, 1922, was followed by a peak in production in November. The agreement throughout is not quite so close as that shown in Figure 26, but it is sufficiently close to illustrate the tendency of production during the winter-feeding period to be influenced by changes in prices that have taken effect a few months previous.

Exact statistical measurement of the usual extent of this short-time effect shows that it is not so important as a cause of changes in production as is the long-time effect previously discussed. On the average, an increase of 10 per cent in the ratio of milk prices to feed prices at Bedford, over a period of three months, caused about 1 per cent increase in production two months later. This did not hold true, however, for the summer months; changes in price ratios had no apparent short-time effect on the summer production. This agrees with the conclusion that a short-time effect operates through the way the cows are fed; during the summer, when they depend upon pasture more than upon feed, changes in feeding would be less important.[20]

The Richmond records lead to about the same conclusion. A 10 per cent increase in the ratio of milk prices to feed prices over a three-month period increased production about 2 per cent, six weeks later.[21] So far as determined this applied to the winter period only,

[19] This ratio is shown as a three-months' moving average to eliminate erratic changes from month to month which apparently are not reflected in production. Both series are expressed as percentages of the corresponding averages for each month to eliminate the usual seasonal variation.

[20] Many of the Bedford dairymen produce truck crops through the summer and pay less attention to the cows, which is another reason why the summer production is not responsive to short-time price changes.

[21] The data at Richmond were for half-month periods, so the exact degree of lag would be more accurately determined.

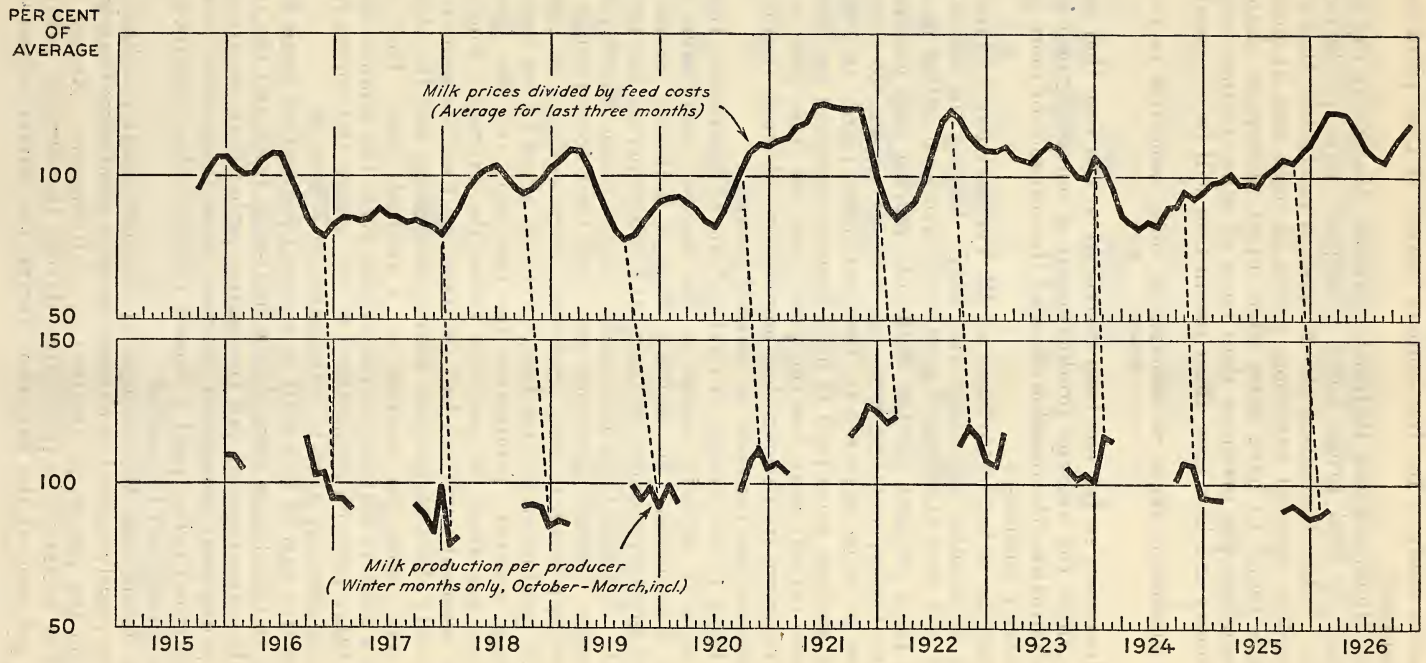

FIG. 27.—MILK PRICES AND WINTER PRODUCTION PER PRODUCER AT BEDFORD, MASS.

Changes in production correspond, to some extent, with changes in ratios of milk prices to feed prices, the production changes usually following two or three months later. Both series are expressed in percentages of each month's average for the period.

for separate analysis for the summer period at that point has not been completed.

At both Richmond and Bedford, therefore, changes in the ratio of milk prices to feed prices affect subsequent milk production per producer. After eliminating the changes in production that are due to the regular seasonal variation, prices of milk and of purchased feeds were found to have more effect upon subsequent changes in milk production per producer than have all other factors combined. Other factors and how they affect production will be discussed later.

EFFECT OF CHANGES IN PRICES TO PRODUCERS ON TOTAL PRODUCTION IN AN ENTIRE STATE

The discussion so far has been restricted to the way that changes in price affect the average production by a selected group of producers, eliminating the possible effect of the entrance of more persons into the dairy business.

The records of total purchases at all Vermont dairy plants were available by months, beginning with 1917. During the last 10 years Vermont and New Hampshire producers have been selling more and more of their product for the fluid-milk market and less and less for cream, butter, or other uses. As a result (as fig. 28 shows, the utilization of milk delivered to Vermont dairy plants in 1926) the weighted average price paid to all Vermont dairymen has increased much more rapidly than has the price paid for fluid milk as such. Total production in Vermont has increased much more rapidly than has production per producer at selected points.

In addition to the change in total volume of production there has been an equally striking change in the seasonal distribution of the Vermont production. In shifting from a butterfat market to a fluid-milk market, production during the winter period was naturally increased. Judging from the change in production throughout the season, many Vermont dairymen now have their cows freshen in the fall, whereas previously they freshened in the spring. As shown in Figure 29, production during June, 1917, was about 70 per cent above the average monthly production for the year, and the December production was about 45 per cent below the average; whereas by 1925, the seasonal variation had decreased so that the June production was only about 50 per cent above the average, and the December 25 per cent below the average in a normal year. This change involved a relative shifting of production from the summer and fall months (May through September) to the winter and spring months (November through April), as indicated in Figure 29.

The greater part of this shift in seasonal production seems to have been due to the change towards the fluid-milk basis and the realization of the advantages of fall freshening, rather than to any similar shift in prices paid throughout the year, since the seasonal variation in the weighted prices paid Vermont producers has remained about the same throughout the period.

It was found that the changes in Vermont total purchases were even more closely related to changes in price conditions than was the production per patron at Bedford or at Richmond. Nearly 82 per cent of the variation in production during the summer period and over 88 per cent of the variation during the winter season can be

explained solely by the previous changes in milk and feed prices. Comparing these results with those obtained for the Richmond and Bedford areas, it appears that the number of producers is even more

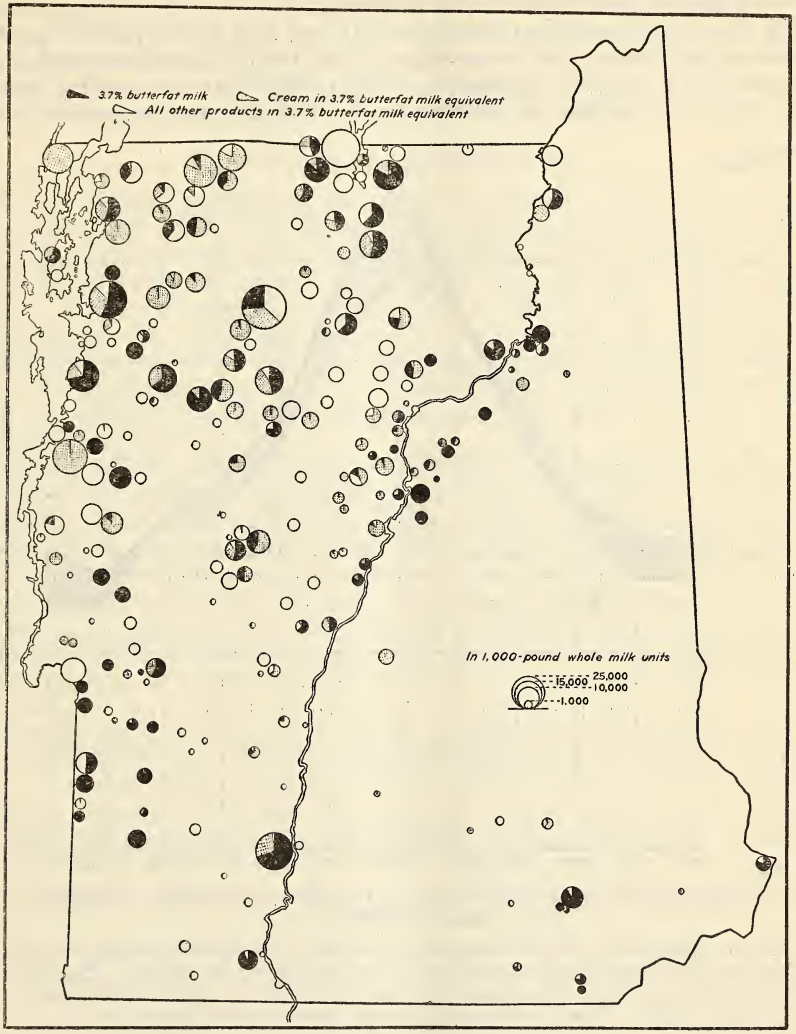

FIG. 28.—VOLUME OF VERMONT AND NEW HAMPSHIRE DAIRY PLANTS AND PERCENTAGE DISTRIBUTION OF VOLUME UTILIZATION, 1926

Most of the plants in Vermont and New Hampshire now ship fluid milk and cream. There are a few condenseries, and a number of small plants still manufacture butter and cheese during the entire year, but the number of butter and cheese making plants grows smaller each year. (Data obtained from Vermont and New Hampshire State departments of agriculture.)

closely dependent upon economic conditions than is the number of cows per producer or the production per cow.

This calculation showed that both the long-time and short-time effect of changes in prices upon production were similar for the

Vermont total purchases and for production averages of individual producers as previously discussed. Just as before, the greatest effect of price changes upon production showed up after an interval of a year or more, while a less marked, but still significant effect, was shown after an interval of a few months.

For the winter period an increase of 10 per cent in the ratio of milk prices to feed prices for the average of the last 12 months caused, on the average, 9 per cent increase in milk production six months later, and 2 per cent increase 18 months later. For the summer period, an

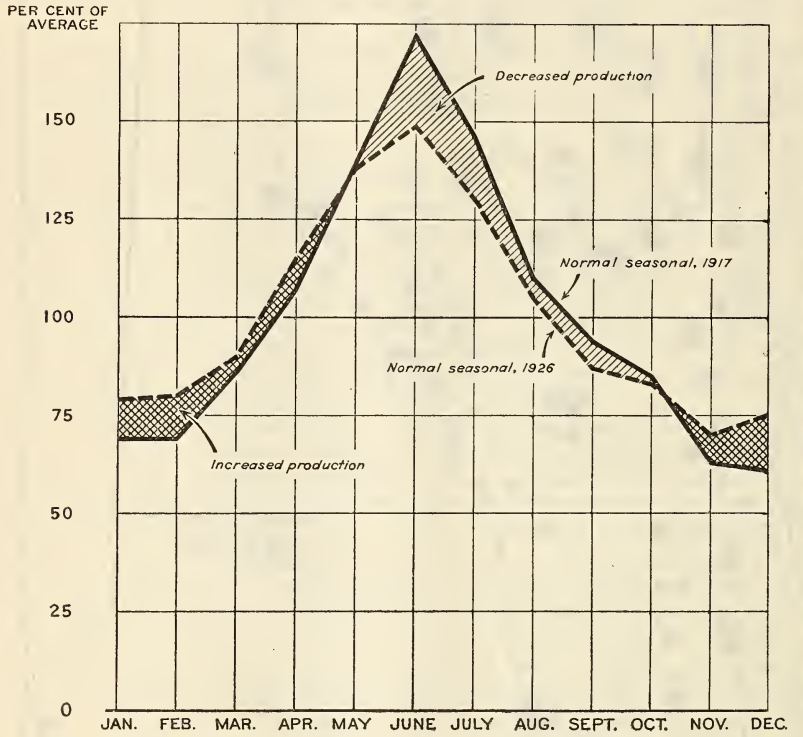

FIG. 29.—SEASONAL VARIATION IN MILK AND CREAM PRODUCTION IN VERMONT, 1917 AND 1926

In 1917 June production was about 70 per cent above the monthly average for the year and December production was about 45 per cent below the average. By 1926 June production was only 50 per cent above the average and December production only 25 per cent below. Total plant production per month is expressed in terms of 3.7 per cent milk. (Data obtained from Vermont Department of Agriculture.)

increase of 10 per cent in the same ratio caused 7 per cent increase in production six months later and 5 per cent increase 18 months later. For both the summer and winter periods, therefore, the maximum effect on milk production came about a year later than the center of the prices which caused it, with some effect persisting until two years after the middle of the year for which prices were averaged.

The long-time effects were almost the same for the data for Vermont as a whole and for the Richmond and Bedford data, but the short-time effects were even more marked for Vermont as a whole. An increase of 10 per cent in the ratio of milk prices to feed prices

for an average of the last three months caused an average increase of 6 per cent in production two months later for both the winter and summer periods. It may be that small producers who would otherwise make butter themselves or use the milk on their farms are encouraged to sell their product when prices advance markedly; producers of this type would be included in the all-Vermont record but excluded from the Bedford and the Richmond averages. To determine whether or not the difference is really significant and the causes of the difference would require further detailed studies.

OTHER FACTORS AFFECTING PRODUCTION

Wages.—Feed constitutes the most important cash cost to milk producers, but there are other important items of expenditures, changes in which might be expected to affect milk production. Of these other items the cost of labor is the largest; hence changes in wages might be expected to have some influence on production. This factor was investigated only in the study of the Richmond production records.[22] There it was found that increase in wage rates did have some tendency to decrease subsequent production but that the influence was small compared with the effect of prices for milk and for feed.

Supply of farm-raised feeds.—In addition to changes in the cost of purchased feeds, milk production is influenced to some extent by the quantity of farm-raised grain and roughage available. Examination of this factor in the Richmond study, considering both corn and hay yields, indicated that another 5 per cent of the variation in winter production could be accounted for by this factor. It was necessary to use yields for the State as a whole in making this computation; were it possible to consider the yields in the specific area being studied, the effect would probably be found to be even more marked.

Weather during the pasture season.—During the times the cows are in pasture dairy production is markedly influenced by natural conditions, especially by the amount of rainfall. No attempt has been made to measure the effect of this factor, except in the case of production per producer at Bedford during the summer season. Here it was found that 6 per cent of the remaining summer variation, after taking account of that caused by changes in milk prices and feed costs, was due to the rainfall. The rainfall did not affect production so much during the same month as it did during the month following. Up to 3 inches above normal it was found that each increase to 1 inch in rainfall above the normal for that month tended to increase production the following month 1.2 per cent, and every decrease of 1 inch below normal had a corresponding opposite effect. Further work on this subject for other areas is needed to determine the effect of rainfall more exactly.

The Bedford area, for which this rainfall study was made, is near Boston, and is a somewhat intensive truck and dairy section. It is probable that in areas where farmers depend upon pasturage to a greater extent than they do in this area differences in rainfall would be found to have a greater effect upon production than they have here.

[22] See footnote 18.

FORECASTING PRODUCTION FROM PRICE CHANGES

The several studies discussed above show that changes in prices of milk, feed, and labor are the most important of the factors affecting subsequent changes in production and that from 55 to 90 per cent of the production changes have followed previous changes in prices. Since the greatest effect becomes apparent after a year or more in most cases, it is possible to use these relations to estimate what changes in production are most likely to occur in the future.

The way in which these forecasts of future production may be expected to work out can be judged from Figure 30. This figure shows the total purchases of milk at all Vermont dairy plants from 1917 through 1926, in terms of 3.7 per cent milk; estimates of these purchases as computed from changes in prices paid farmers and in feed costs, including both the short-time and the long-time effects, and estimates of purchases, considering the long-time effects only. Since the short-time effects of the average ratios of milk prices to feed prices for the last three months at any time do not appear until two months later, the changes shown in the first-mentioned curve are computed from data available two months earlier. The long-time effects of changes in the prices for the average of the past twelve months do not begin to appear until six months later, so the curve showing the long-time estimate is computed from data available six months earlier. Thus, by using this long-time relation, the most probable changes in milk production can be estimated six months in advance.

The statistical analysis on which the estimates shown in Figure 30 were based covered only the years 1917 to 1925, as data for 1926 were not available when the study was begun. Estimates for the period 1917 to 1925, including both the long-time and short-time effects, agreed with the actual purchases each month within an average error of but 3,000,000 pounds. Actual monthly purchases during the period varied from 40,000,000 to over 120,000,000 pounds. The estimates for 1926 and 1927 were really forecasts, since each estimate was based solely upon information available six months earlier.

The estimates of the third curve were naturally not so accurate, since they did not include those short-time effects which must be added to the long-time effects to get the full measure of the readjustments to price changes. For the period 1917 to 1925 the average error from this estimate was 5,000,000 pounds, and for 1926 it was 4,500,000 pounds. The estimates of production during the first half of 1927 and the forecasts of production for the second half are interesting as indicating what the general trend of production is likely to be through the rest of this year, should farmers continue to react to changes in prices as they did during the past decade.

In computing these forecasts for 1927, prices paid to producers in Vermont up to 1927 were estimated from the composite prices of the New England Milk Producers' Association, as the prices actually paid are not available until reports for the year are published by the Vermont commissioner of agriculture. Use of these estimated prices may make the forecasts slightly less accurate than are the earlier estimates. The forecasts (made June 20, 1927) indicate that, during October and November, 1927, production in Vermont is likely to be about 5 to 10 per cent higher than in the same months of 1926.

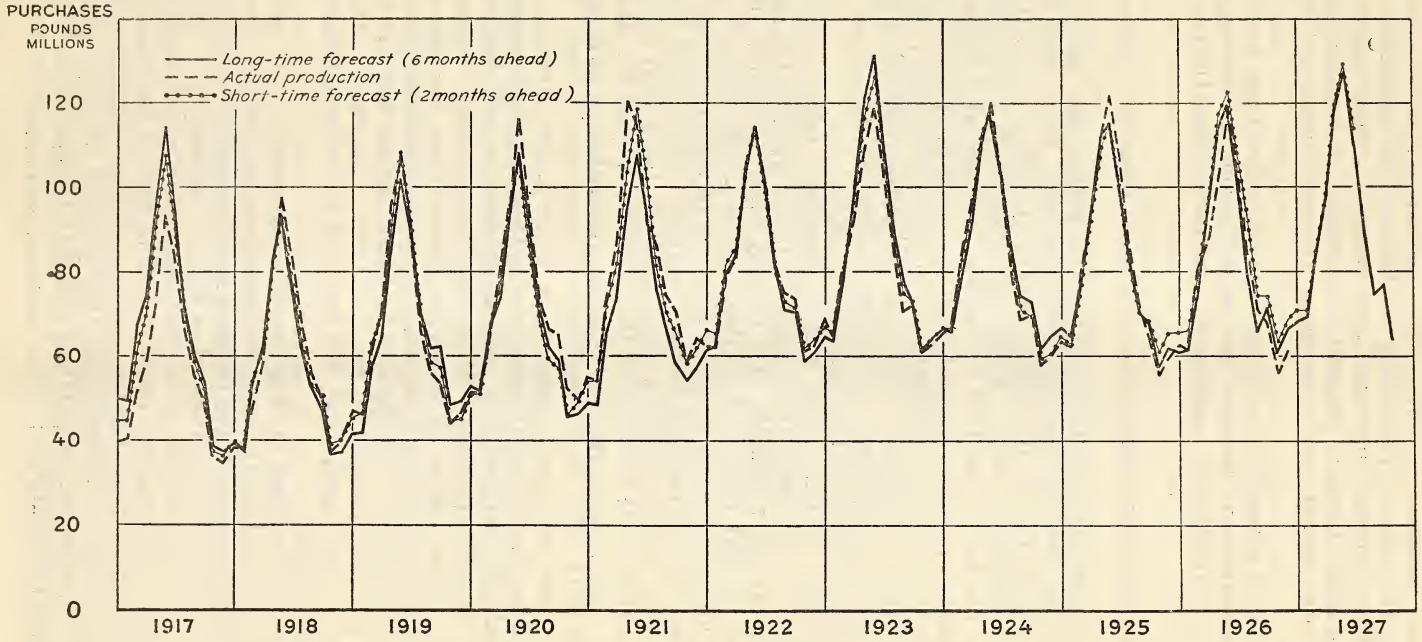

FIG. 30.—ACTUAL, ESTIMATED, AND FORCASTED DELIVERIES AT VERMONT PLANTS, CONVERTED TO 3.7 PER CENT MILK

The most probable changes in milk production can be estimated six months in advance. Forecasts for 1927 were made June 20, 1927. (Based on data obtained from Vermont State Department of Agriculture.)

As further studies are completed, it may be expected that the relations shown by these preliminary studies will be modified to some extent. This general conclusion seems likely to stand, however: In producing milk, farmers respond to economic influences; and the prices of milk and of feeds are among the most important of these influences.

According to present plans, the statistical studies from which these results were taken will be published in full in the forthcoming bulletins of the agricultural experiment station of the University of Vermont.

RELATION OF BASIC ECONOMIC FACTORS TO MILK-PRICE POLICIES

To be successful during a considerable period, any price policy must meet the needs of the situation involved. To do this it must establish a price that is fair both from the producer's and from the consumer's points of view. From the consumer's standpoint, the price must not be so high that he can not purchase an adequate supply. From the producer's standpoint the price must not be so low as to make production unprofitable. To give satisfaction, any price plan must aim to establish a price at which the quantity produced and the quantity consumed will be maintained in such balance that drastic readjustments will not necessarily occur.

The quantity of fluid milk which consumers take is only very slightly affected by moderate changes in price, whereas the quantity produced responds markedly and rapidly both to changes in milk prices and in feed prices. For that reason if the price is placed either too high or too low its effect may not be apparent until farmers have had time to readjust themselves to it. If the price is set too high, the effect on consumption may be slight; but a year or so later production will swell far beyond the quantity needed for fluid consumption. Then prices must be sharply reduced or a large proportion of the milk must be diverted to less remunerative uses. Either of these courses ultimately reduces the price to the farmers.

On the other hand, should prices be fixed too low consumption may not be much affected, but after a time production will begin to decrease and soon the quantity will be insufficient to meet the consumption needs. Other areas may then be drawn upon to make up the deficit or prices may be so advanced as to cause some consumers to use less milk; in either case the farmers will have lost part of their outlet, and later on when production has had time to respond to the price change and expand again they will be faced by reduced demand and greater competition.

The relations between milk prices and consumption are such that the prices can not be left to work themselves out through the interplay of immediate supply and demand as with most other agricultural products. Retail prices have such a slight influence upon milk consumption that if all the effects of changes in production were thrown upon the fluid-milk market, prices would be erratic beyond measure. If production was only slightly in excess of fluid requirements, the price would drop precipitately to the value of the milk for other uses, and if production was slightly less than the needs for fluid milk prices would rise sharply.

Since milk is bought chiefly as a staple food in regular quantities each day, consumers must be assured of a steady, continuous supply. It is to the consumers' interest that average production should be somewhat in excess of demand in order to take care of the daily fluctuations which are due to temperature changes and other influences. Yet such a margin of safety can not be provided if its presence penalizes the farmers through too low a price for all the milk they produce. These circumstances, plus the fact that milk must be handled daily with dispatch and cleanliness, have led practically every market to establish methods of buying milk upon a fixed-price basis which remains unchanged for two weeks or a month, or even longer. In many markets more or less elaborate modifications have been provided for arriving at prices on different bases for the quantity actually moving into fluid consumption and for the remainder which is disposed of in less-valuable products; but in every case some kind of fixed or contract price is established for specified periods. Milk is almost the only important agricultural product that is sold upon such a contract basis.

Any marketing organization which makes prices for fluid milk should know the basic facts as to the relation of price to consumption and to production for the territory which it represents, and should give due consideration to these elements when considering changes in prices. They can utilize knowledge of the usual effect of milk prices and feed costs upon production, not only in estimating what changes in production are likely to occur but also in judging of the probable effect of any proposed change in prices upon production. To the extent that this is done advance knowledge of how prices are likely to work out can be substituted for experimental methods. As continual experimentation is prevented and steadier and more equitable prices are established both producer and consumer will profit.

PLANS FOR PRODUCER CONTROL OF PRODUCTION AND PRICE

The choice of a price plan, or the introduction of any system of production control, should depend chiefly upon the economic conditions that exist in the milk shed and in the market in which the plan is to operate. An arrangement that is highly successful in one market may fail in another. Each market is a problem within itself, but a plan that has been successful in one market is likely to succeed in another market under substantially similar circumstances and management.

When a flat price is paid for milk the dealer takes the risk and attempts to arrange prices to producers that are low enough to compensate him for the risk assumed. It is not generally known by the producers just how much is necessary to compensate the dealer for the risk involved. Therefore when all dealers in a market are buying on this basis it is possible for them to take a larger portion of the sale price than is really justified.

If the price risks are taken by the producers, and the product is bought by the dealers on the basis of ultimate use (assuming that an accurate accounting is made of the use of all the milk purchased), the producer may obtain more nearly the market value of his product. In order to accomplish this, however, any price plan must be so ad-

justed as to require the dealer to pay prices that are commensurate with what he receives for the milk. If the plain fails in this respect, either the producer or the dealer suffers a loss. In case the producer loses, he may continue production to some extent regardless of the fact, but if the dealer loses he either goes out of business or seeks another purchase plan.

Price plans in use, in addition to the employment of a flat price, may be roughly classified as (1) what is sometimes called the "Basic Rating plan," and (2) the "Use plan."

THE BASIC RATING PLAN

The Basic Rating plan differs from the Use plan in that a basic quantity is established for which the dealer pays an agreed price. This price is usually arranged at a meeting of the dealers and the representatives of the producer organization. For the milk delivered in excess of the basic quantity, the price may be calculated on the basis of some stipulated formula. The primary object of this plan is production control through the regulation of seasonal supply. By this means it is hoped to obtain higher prices for the producer and greater possible profits for the dealer. Thus the Basic Rating plan provides both a scheme for production control and a method of determining prices to producers. The cooperative associations that supply milk to Baltimore and Philadelphia have successfully operated this plan. The plan as used by the Inter-State Milk Producers Association of Philadelphia, and sometimes called by that association the Philadelphia plan, is one form of the Basic Rating plan.

THE PHILADELPHIA PLAN

The Philadelphia plan involves, first, the establishment by each producer of a basic quantity. The basic quantity as used by the association during its operation under this plan, from 1920 to 1926, has been the average production by each producer for the months of October, November, and December. That is, for the nine months following December 31 of any year, the producer received the basic price agreed upon [23] for a quantity of milk equal to the average made by his herd during the previous three-month period. The basic prices are determined in conference by dealers and representatives of the Inter-State Milk Producers' Association, who meet at the offices of the association. The agreed price is determined upon the basis of market conditions and the best available forecasts of future supply. Prices are not set for any stipulated period of time but are subject to change whenever market conditions warrant it.

For any milk exceeding the producer's basic quantity, and not more than equal to it in quantity, the producer receives the "first-surplus" price. This price includes payment for the butterfat content at the average price per pound for New York 92-score butter for the current month, plus an additional 20 per cent.

If the quantity of milk delivered is greater than twice the basic quantity, the butterfat content of the excess (the "second surplus")

[23] F. o. b. Philadelphia less differentials for transportation and an adjustment for varying butterfat content.

is paid for at the average price of New York 92-score butter for the current month. First and second surplus prices are f. o. b. shipping station and are not subject to transportation differentials.

To illustrate the plan, assume that a patron produces an average of 2,000 pounds of milk per month during the months of October, November, and December of a given year. For his entire production during these months he receives basic prices. The 2,000 pounds per month becomes his basic quantity for the following nine months. If in the following May he produces 5,000 pounds of milk, he will receive basic prices for the first 2,000 pounds. For an equal amount, or for 2,000 pounds more, he will receive the first-surplus price, including payment for butterfat content, at May butter prices plus 20 per cent, as stated above. For the additional 1,000 pounds he will receive for the butterfat content the May average for New York City 92-score butter prices without the additional 20 per cent.

In plans in which the basic quantity is established by taking the average of some production period, the most desirable period is that when the supply and fluid demand of the market are most nearly in adjustment. In the Baltimore and Philadelphia associations, however, no method of penalizing the member for production below his basic quantity has been employed. Contracts might be employed by associations for establishing a basic quantity with a penalty for underproduction as well as for overproduction.

THE USE PLAN

The Use plan, also known as the Classification and Surplus plan, requires that the dealer pay for the milk according to the use which is made of it. The theory is that milk for fluid consumption is worth more than milk for manufacturing purposes; that the consumers of fluid milk will pay increased prices without curtailing consumption; and that higher fluid-milk prices will have less tendency to result in an increase in supply than is the case with the price of milk-manufactured products. The neighboring producer enjoys a partial monopoly of the fluid-milk market, but for that portion of his product sold for manufacturing purposes he may have to compete on a country-wide or world basis with producers in other localities who have not the advantages of a fluid market.

The Use plan is employed by a large number of the fluid-milk cooperatives, including both marketing and bargaining associations. The bargaining associations do not possess facilities for handling the physical product, but confine their activities to representing a group of producers largely in negotiations with dealers and distributors of milk regarding prices and terms of sale and to securing for the dealers an adequate supply of high-quality milk. The marketing associations handle the physical product and perform part or all of the functions of the private dealer or distributor.

THE USE PLAN AS EMPLOYED IN THE BOSTON MILK SHED

Most milk in New England is sold essentially on the Use plan. The following statement from a brief by New England milk shippers

to the Interstate Commerce Commission [24] describes the plan as now in effect in that region:

The New England Regional Milk Commission, a Federal board set up by the Food Administration in 1917, prescribed the prices to be paid to the farmer for milk in 1918 and 1919. These prices were made on a delivered basis at the market, the farmer paying the cost of transportation, the cost of cans, and the cost of operating the country receiving stations. Separate prices were made for such milk as was sold in its fluid form, and for other milk which was treated as surplus milk, the surplus price being lower than the fluid-milk price. This plan has been continued in effect with some minor changes, and under it the farmer delivers all his milk during the entire period of the year, and receives a final composite price based on the percentage of total milk delivered to the dealer which was sold as fluid milk, and the percentage which was used as surplus milk. The advantage to the farmer of this price system is that under it the farmer is assured of a market for all his milk, though the market may only need his total production during the periods of lowest production. In other words, while the farmer receives the maximum price only on such of his milk as is actually shipped and sold as fluid milk, he is protected during the flush season from a lack of market for his production during that period. It should be remembered, however, that the fluid-milk price of milk does not represent the actual return to the farmer, since his actual returns are reduced

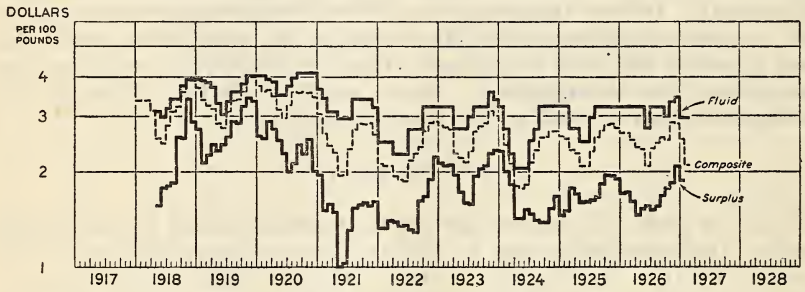

FIG. 31.—PRODUCER PRICES FOR MILK IN NEW ENGLAND FREIGHT ZONE 10

The composite price curve represents prices actually received by producers. These are weighted by the relative quantities of milk used for fluid and surplus purposes. (Source of data: New England Milk Producers Association.)

in proportion to the amount of his milk that is sold as fluid milk but is used for the manufacture of cream, butter, and other by-products.

Figure 31 shows prices received by members of the New England Milk Producers' Association while operating under the above plan, 1917 to 1926.

THE USE PLAN AS USED BY THE DAIRYMEN'S LEAGUE COOPERATIVE ASSOCIATION, INC.

The Dairymen's League Cooperative Association, Inc., may be taken as another example of a marketing association that employs the use plan. The league has contracts with the producers, and it pools the milk produced. The association owns a large number of plants. Some members, however, deliver to plants that are owned by distributors who buy their milk from the league. These dealers pay the association for the milk, and the association in turn pays the producer the pool price for his product, taking into consideration equitable differentials for butterfat content, quality, and transporta-

[24] Interstate Commerce Commission, I. and S. Docket 2635, Brief for Protestants, pp. 177 and 178.

tion. All producers who live in the same transportation zone and ship milk to New York, although to different dealers, receive the same price for milk of the same grade and quality.

The league does not retail milk, but sells it to distributors. Each dealer pays for the milk purchased according to the use which he makes of it. The following classes of milk, according to use, have been employed: (1) Fluid milk; (2) milk for cream and ice cream; (3) condensed milk; and (4) milk for butter and cheese. Various modifications have been made from time to time when market conditions justified, but fluid milk, which is always in the first class, remains the product which is the most valuable and for which the least competition is met from sources outside the market's milk shed. Milk for sweet cream is always in the second class, and although it may have to meet more competition from outside the milk shed, its sale price is such that the dealer can afford to pay almost as high a price for it as for fluid milk. For milk in the last class, if there is an available supply, the price must be determined on a country-wide or world-market basis instead of on the supply and demand conditions of the particular milk shed.

SOME PROBLEMS IN ADMINISTRATION OF THE USE PLAN

All marketing and bargaining associations that receive payment on the basis of the use made of the milk employ some system of classification. Sometimes it may involve only two or three classes. When only two classes are provided, unless cream for table use is grouped with milk used for fluid consumption, the producer may fail to get the full market return for all of his product. A threefold classification, as employed by some of the associations, may eliminate this difficulty, and in many instances may prove more desirable than an elaborate classification plan.

The employment of the Use plan by shifting the risk to the producer, where it must eventually fall in any case, should make possible the receipt by the producer of all the market affords. To accomplish this the plan must be honestly and efficiently administered, both as to reporting the uses made of the milk and in controlling the extent of the milk shed. Dealers who are anxious to increase their volume must be prevented from extending the milk shed beyond the limits necessary to furnish an adequate fluid-milk supply.

The dealer who wants a larger volume may look favorably on an increased surplus and may establish contacts with producers and other sources of supply so that he has a large surplus even in short seasons of the year. Such a policy can not fail to decrease returns to producers in a given milk shed. Where there is a marketing association which is in a position to supply all the dealers with their total requirements at any time such difficulties are not so likely to occur. Some bargaining associations enjoy a high degree of cooperation with the dealers and are able to render such service as to leave little room for difficulty of this sort.

CONTRACTS WITH PRODUCERS

The contract method of production control has been employed in combination with the Use plan by some associations. The Connecticut

Milk Producers Association operates on such a combination plan. The producer stipulates before March 31 of each year the daily amount which he agrees to deliver for the year following May 1. The milk from all producers who sell to a certain dealer is put into a monthly pool, and all the producers who are located at the same point are paid the same price for the contracted quantity of milk of the same quality and butterfat content. Producers at that point who sell to another dealer will receive a slightly different price if the proportions used as fluid milk by the dealers are different.

In arriving at a price according to use four classes are employed by the Connecticut Milk Producers Association: (1) All milk sold in fluid form; (2) milk made into cream that is sold in fluid form; (3) milk made into manufactured products except butter; (4) milk used in making butter.

Prices for class 1 milk are determined from time to time by agreement in conference between the dealers and a committee from the producers' organization. Prices for class 2 milk are determined by formula; that is, the butterfat is paid for at 22½ cents above the average monthly Boston wholesale price of 92-score butter, the milk going with the fat. For class 3 milk the price received for the butterfat is 10 cents above the monthly average 92-score butter price in Boston, the milk going with the fat. For class 4 milk the price paid for butterfat is the average monthly Boston price of 92-score butter.

In case the producer delivers during any month either more or less than the average daily quantity provided for in the contract, he receives for all milk above the quantity stipulated in the contract 2 cents per quart less than the agreed price, and for each quart of the contracted quantity which the producer fails to deliver he forfeits 2 cents. These penalties are placed in a special fund and are prorated back to the producers. The result is, in effect, a bonus for the members who produce exactly the amount contracted. Producers who vary only slightly achieve practically this result, whereas the offender who has high seasonal variations is penalized accordingly.

The Ohio Farmers Cooperative Milk Producers Association, Cleveland, Ohio, also has made use of the contract for production control combined with a use plan. The milk of the entire organization is pooled and the producer receives from the association the pool price. Dealers pay the association for the milk on the basis of the use made of it. In the operation of the plan the producer states, before May 10 each year, the total quantity of milk which he will supply to the association during the 12 months following June 1 thereafter. One-twelfth of this quantity is then taken as the specified quantity which he will supply to the association each month. The sum of all these monthly contracts is the total which the association can contract to supply to the dealers. If the total milk delivered by a member in any month exceeds his contracted quantity, only that portion which he has contracted is entered in the pool and paid for at pool prices. The quantities delivered by members in excess of their contracts are sold and the producers receive an average of such price as the association is able to obtain, minus the necessary handling charges and other deductions authorized by the board of directors of the association under authority of the advisory council.

In case the actual total production of all members falls below the total quantity contracted by the association, the board of directors has power to authorize the purchase of milk and cream outside the membership of the association. The difference between the amount paid for such milk and cream and the price received for it by the association is charged to accounts of the delinquent producers and deducted from their milk checks on the basis of the difference between the quantity each has contracted to produce and his actual deliveries.

THE PLANS COMPARED

The contract method of regulating production requires the use of a penalty for low production. The Basic Rating plan, as used in the Philadelphia and Baltimore associations, exacts no penalty for production under the basic quantity. The fact that the producer may try to make his basic period the time of peak production, with the result that he has no surplus throughout the year, may tend to defeat the object of the Basic Rating plan. Such group action, though not consciously concerted, will have the effect described. Variations in topographical conditions which influence production costs may aid in preventing group shifts within a milk shed, but in some instances it has been found necessary to change the basic period when occasion required.

The Basic Rating plan will be more likely to succeed where the limits of the milk shed are fairly well defined and where production is not greatly in excess of fluid requirements. Producers in sections where there is much natural pasture land may oppose the plan, since these producers may be able to produce more cheaply a varying rather than a constant supply of milk.

The operation of any production-control plan which aims to bring about an even supply of milk throughout the year is likely to fail unless its adoption is general over the larger part of the actual or potential sources of fluid-milk supply.

The Basic Rating plan of sale and production control probably requires a higher degree of skillful management than does the Use plan. That is, the latter is inherently more self-adjusting and takes care of its own course more easily. Given a highly capable and aggressive management, the Basic Rating plan will secure all the market affords and may result in slightly higher prices to producers than does the Use plan. That is because it tends to prevent dealers from obtaining large surplus quantities of milk and resulting decreased prices to producers. If this tendency is eliminated and the supply of milk is the same, the two plans should give about the same returns.

PRODUCER COOPERATION IN THE NEW ENGLAND MILK INDUSTRY

It can scarcely be overemphasized that the immediate need in the New England milk industry is coordination—coordination in production, assembling, converting, shipping, and city distribution. The present lack of coordination is not the fault of any one group. The rapid expansion of the entire industry and the keen competition within all of its branches and with other areas have accentuated and increased the number of problems and their complexity. But the

industry can not proceed in the future as it has in the past without bringing large losses to all concerned. Something must be done to create a more efficient marketing machine, but drastic, one-sided action on the part of any one group will not bring permanent and satisfactory results.

Effective cooperative organization, predicated on a firm foundation of ably managed country plants throughout New England is needed. This will make possible the consolidation of upcountry plants in those cases where the volume now handled by a plant at an assembling point is insufficient to permit operating and shipping economies. Producer-consignee cooperation at terminal markets will effect savings in freight charges by creating facilities for receiving in car lots or tank-car lots rather than in less-than-car-lot loads.

In addition, such a producer organization, because of the control of adequate supply and of conversion facilities, will be in a position so to adjust its output as to meet market requirements for milk and milk products more accurately than do the present plants. By so doing they will be able to obtain the best prices in a given market.

Furthermore, a full recognition of price-making and other economic forces and their proper application by producer organizations will be a dynamic instrument for stabilizing the entire dairy industry in New England.

SUMMARY

Metropolitan Boston is New England's major milk and cream market. In 1900 Boston's milk and cream supply came largely from New Hampshire and southern Massachusetts, but in 1926 most of it came from Vermont. In the winter and spring months some cream is brought from points as far west as Kansas and as far north as Quebec.

The bulk of the milk supply of metropolitan Boston moves by rail from zones in Vermont and New Hampshire 180 to 240 miles from the market. In June the cream shipments are relatively greater than are those of milk. In September milk shipments are relatively greater, so that, although production is lower in September, more car space is required. Less than 10 per cent of Boston's total daily milk supply is hauled in by auto truck.

Because of recent changes in freight rates in New England, some milk producers who formerly shipped to Boston may find it equally or more advantageous to ship to other large markets. Considerable readjustment of milk-shed boundaries may be the result; competition in some sections will be increased, and prices to producers will tend to rise.

Use of tank cars for shipping milk in New England until June, 1917, was limited to a single car. Increased use of tank cars at points where whole tank-car lots (24,000 quarts) of milk are available each day would result in considerable savings in freight and handling costs, if special tank-car rates could be obtained.

A number of milk-shipping points in Vermont and New Hampshire have sufficient average volume to make regular daily car-lot shipments, but because of the absence of coordination, either among shippers at these shipping points, or among receivers at terminal

receiving stations, or both, much milk and cream that could move under car-lot rates now moves under less-than-car-lot rates.

For economical operation, from the standpoint of costs, the annual volume of milk per plant should be not less than 7,000,000 to 8,000,000 pounds. When costs of hauling to the plant and transportation to market are considered, for the densities of production usually existing, the minimum per-unit cost of operation is reached at an annual volume of about 10,000,000 pounds, under the usual seasonal variation. This would give a minimum daily volume of a carload or two hundred and twenty to two hundred and fifty 40-quart cans.

In sections where milk production is heaviest there is considerable overlapping of plant areas. This may not mean that there is unnecessary duplication of routes, provided each plant has sufficient volume for economical operation. The area covered by a given plant is determined chiefly by density of milk production, size of plant, neighboring competition, condition of roads, and hauling charges. Most routes are between 4 and 12 miles in length, as hauling must be by wagon unless roads have hard surface, but the use of motor trucks for hauling is increasing.

Analysis of the situation in metropolitan Boston in June, 1927, indicates that licensed stores sold approximately 12 per cent of the total retail-milk volume. Practically all of this milk was sold at prices that were 2 cents lower than those charged for milk that was delivered by wagon. In a few New England cities, bottled milk is sold by licensed stores at a price that leaves no margin of profit to the stores. Such a practice is not only injurious to the stores themselves but reacts toward instability and demoralization of the entire industry.

Changes in retail prices of fluid milk have little effect on consumption. Surplus quantities of milk can not be disposed of by reducing prices a moderate amount, as is the case with most other agricultural products.

On the other hand, changes in milk prices to producers (relative to feed costs) have a marked effect on production. This effect may not be apparent at once, but reaches its maximum in 6 to 18 months after the price change occurs. Changes in production are brought about through changes in number of producers, in the number of cows per producer, or in production per cow through more or less intensive feeding. Other factors affecting production are wages, the supply of farm-raised feeds, and the weather during the pasture season. By taking these factors and price changes into consideration, the most probable changes in production can be forecast six months in advance.

Several plans for systematic control of production and price by producers have been adopted and put into operation by cooperative associations of milk producers. These are, for the most part, modifications of the Use plan and the Basic Rating plan. The Use plan is a scheme of payment to producers according to utilization of the product. The Basic Rating plan requires each producer to supply a stipulated quantity (based on his production during some specified period) throughout the year in order to receive the maximum of "basic" price for all of his product.

Effective cooperative organization of producers is needed in the New England milk industry. This would facilitate the consolidation of many upcountry plants and would aid producer-consignee cooperation at terminal markets. This cooperation would make possible substantial savings in transportation and plant-handling costs. Such an organization would be in a position so to adjust output as to meet market requirements for milk and milk products more accurately than is now done. The best prices afforded by a given market could then be obtained. Recognition and application of price-making forces by such an organization would be a dynamic instrument for stabilizing the entire dairy industry in New England.

APPENDIX A

SUGGESTED PLANS AND EQUIPMENT FOR COUNTRY MILK STATIONS[25]

The principal items of equipment required by the respective types of plants specified are enumerated in the following lists. Only approximate cost figures can be given, as costs will depend upon the type and quality of machinery purchased. In case city water is not used, additional equipment for pumping from a well must be provided. At each of the plants a certain quantity of general equipment and supplies will be required, such as brushes, tools, sample and test bottles, pipettes, thermometers, and office furnishings.

RECEIVING, COOLING, AND CANNING STATION WITH DAILY CAPACITY OF 2,500 GALLONS

Principal items of equipment required

[Estimated cost, approximately $10,000]

One two-compartment weigh can, capacity 1,000 pounds.
One dial scales, 1,000 pounds capacity.
One milk-can drainer.
Two receiving and standardizing vats, capacity 400 gallons each.
One milk pump, capacity 8,000 pounds per hour.
One milk cooler, capacity 8,000 pounds per hour.
Two can washers.
One 36-bottle Babcock tester.
One 20-horsepower boiler with accessories.
One 10-ton compressor with accessories.
One insulated brine tank.
One brine pump with necessary piping.
One can filler.
One sink.
Necessary steam and water piping and fittings.
Necessary sanitary piping and fittings.
Conveyors, motors, shafting, etc.

If equipment for artificial refrigeration is not provided the initial investment is reduced by about $2,500 to $3,000, but an ice house must be provided.

If some of the milk is to be separated and cream shipped, the following additional equipment would be required:

One separator, capacity 4,500 pounds per hour.
One cream vat, with coils.
One can filler.
One skim-milk tank.
One skim-milk pump.
Total additional cost, $1,500 to $2,000.

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[25] This section was prepared by C. E. Clement, of the Bureau of Dairy Industry, at the request of the Bureau of Agricultural Economics.

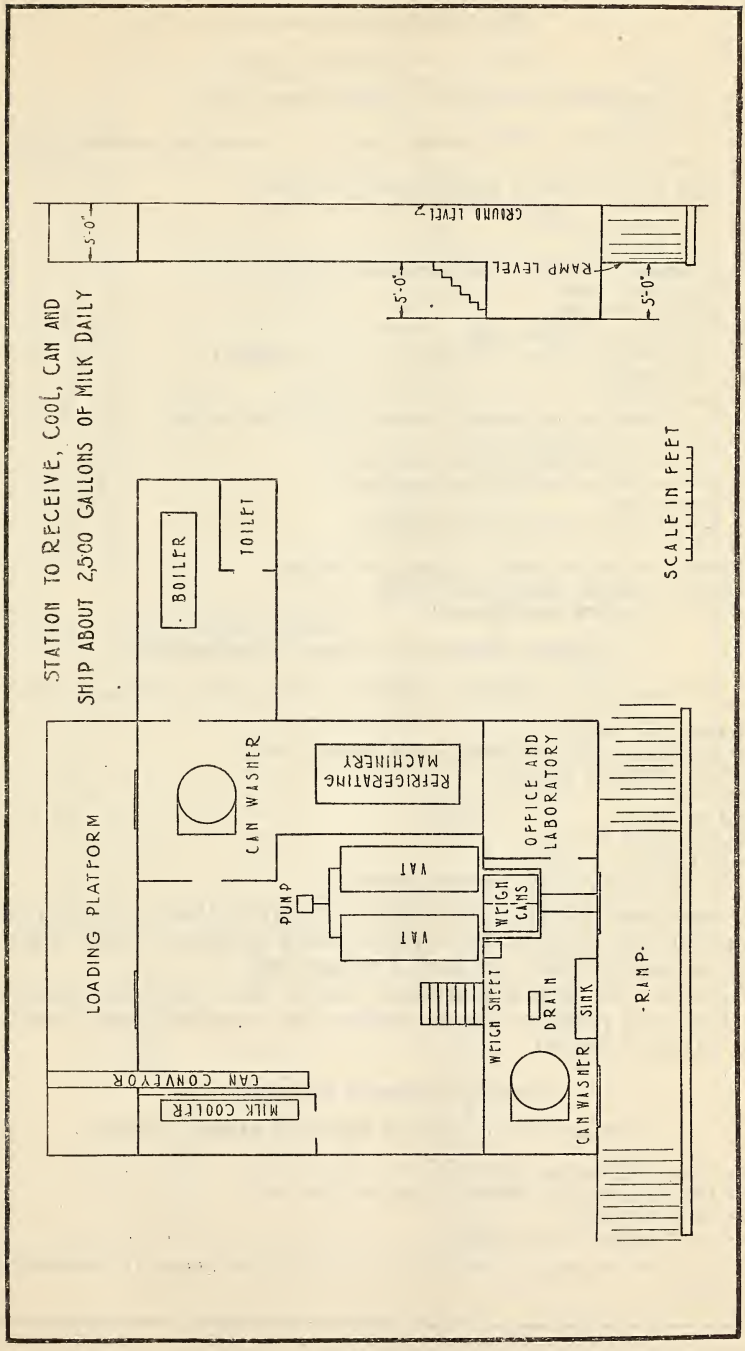

FIG. 32.—A plant of 2,500 gallons capacity could handle daily shipment of one carload of fluid milk (floor plan drawn by Bureau of Dairy Industry)

RECEIVING, COOLING, AND CANNING STATION WITH DAILY CAPACITY OF 4,000 GALLONS, AND WITH AUXILIARY EQUIPMENT FOR MANUFACTURING MILK PRODUCTS

Principal equipment required

[Estimated cost, $15,000 to $20,000]

One two-compartment weigh can, capacity 1,000 pounds.
One dial scales.
Four vats with coils, 400 gallons capacity, for receiving, standardizing milk, cream storage, etc.
One milk pump, capacity 12,000 pounds per hour.
One milk cooler, capacity 12,000 pounds per hour.
One can filler for milk.
One milk heater.
One separator, capacity 4,500 pounds per hour.
One skim-milk tank.
One skim-milk pump.
One skim-milk storage tank.
One can filler for cream (if cream is to be shipped).
Two can washers.
One can drainer.
One churn and butter worker, capacity about 600 pounds.
One 36-bottle Babcock tester.
One 50-horsepower boiler with accessories.
One 20-ton compressor with accessories.
One brine tank.
One brine pump, with necessary piping.
One sink.
Necessary steam and water piping and fittings.
Necessary sanitary piping and fittings.
Conveyors, motors, shafting, etc.

Auxiliary equipment for casein manufacture[25]

[Estimated cost of auxiliary equipment, approximately, $1,500 to $2,000]

Precipitating vats.
Drying funnel, with fan blower and heating coils.
Drying trays and trucks.
Curd mill.
Curd press.
Press dividing boards.
Drain rack.
Cloths for draining and pressing the curd.

In some cases the wet curd itself is shipped; then only the precipitating vats, drain rack, curd press, dividing boards, and cloths for draining and pressing the curd are required.

If cheese is to be manufactured, two or three jacketed cheese vats, together with pressure cheese presses, are required, which will cost from $2,000 to $3,000.

Auxiliary equipment for condensing

[Estimated cost of auxiliary equipment, $7,000 to $8,000]

One 5-foot condensing pan.
Two hot wells, or one preheater and one hot well.
One vacuum pump.
Necessary piping and fitting.

The boiler horsepower would have to be increased if condensing is to be done.

[25] For further information regarding equipment for manufacture of casein, see United States Department of Agriculture Bulletin No. 661.

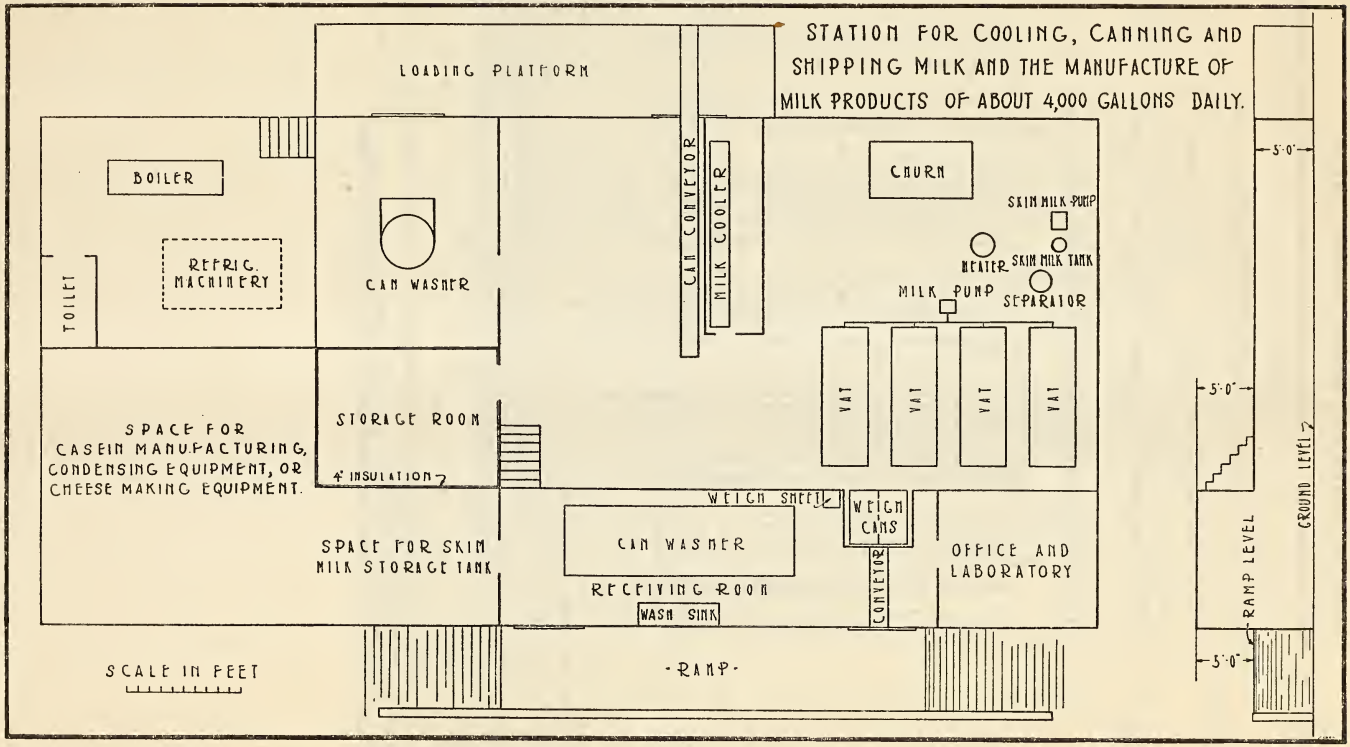

FIG. 33.—A plant of 4,000 gallons capacity could handle one carload of fluid milk daily and, in addition, provide for the manufacture of a considerable surplus (floor plan drawn by Bureau of Dairy Industry)

APPENDIX B

FREIGHT RATES AND MISCELLANEOUS TABLES

TABLE 12.—*Old schedule of rail rates*[1] *on milk and cream, New England territory*

[Source—Interstate Commerce Commission Tariff Schedule No. 4168]

Zone	Distance	Less-than-carload shipments				Car-lot shipments				Tank car per quart[6]	
		Per 40-quart can[2]		Per 12-quart case[3]		Per 40-quart can[4]		Per 12-quart case[5]			
	Miles	Milk	Cream	Milk	Cream	Milk	Cream	Milk	Cream	Milk	Cream
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1	1- 20	17.5	21.5	10.0	12.5	15.0	18.5	7.0	9.0	00.36	00.46
2	21- 40	21.0	26.0	12.5	15.5	18.0	23.0	9.5	12.0	00.44	00.55
3	41- 60	24.0	30.0	14.5	18.0	21.0	26.5	11.5	14.0	00.52	00.64
4	61- 80	27.0	33.5	16.0	20.0	23.5	29.5	12.5	15.5	00.58	00.72
5	81-100	29.5	37.0	18.0	22.0	26.0	32.5	14.5	17.5	00.64	00.79
6	101-120	32.0	40.0	19.0	23.5	28.0	35.0	15.0	19.0	00.68	00.85
7	121-140	34.0	42.5	20.5	26.0	30.0	37.0	17.0	20.5	00.73	00.91
8	141-160	36.5	45.5	21.5	27.0	32.0	39.5	17.5	22.0	00.77	00.96
9	161-180	38.5	48.0	23.0	29.0	33.5	42.0	18.5	23.5	00.82	01.01
10	181-200	40.0	50.0	24.0	30.0	35.0	44.0	20.0	24.5	00.85	01.06
11	201-220	42.0	52.0	25.0	31.0	36.5	45.5	20.5	26.0	00.89	01.12
12	221-240	44.0	54.5	26.0	32.5	38.0	47.5	21.5	27.0	00.92	01.15
13	241-260	45.0	56.5	27.0	33.5	39.5	49.0	22.0	27.5	00.96	01.20
14	261-280	47.0	59.0	27.5	35.0	41.0	51.0	23.0	29.0	01.00	01.24
15	281-300	48.5	60.5	29.0	36.0	42.5	53.0	24.0	29.5	01.03	01.28
16	301-320	50.0	62.5	29.5	37.0	44.0	54.5	24.5	30.5	01.06	01.32
17	321-340	51.0	64.0	30.5	38.0	45.0	56.0	25.0	32.0	01.09	01.36
18	341-360	53.0	66.0	31.0	39.0	46.0	57.5	26.5	32.5	01.12	01.39
19	361-380	54.0	68.0	32.5	40.0	47.5	59.0	27.0	33.5	01.15	01.43
20	381-400	55.0	69.0	33.0	41.0	48.5	60.5	27.5	34.0	01.18	01.48
21	401-420	57.0	71.0	33.5	42.0	50.0	62.0	28.0	35.5	01.20	01.50
22	421-440	58.0	72.5	35.0	43.0	50.5	63.0	29.0	36.0	01.24	01.54
23	441-460	59.5	74.0	35.5	44.0	51.5	65.0	29.5	36.5	01.26	01.57
24	461-480	60.5	75.5	36.0	45.0	53.0	66.0	30.5	38.0	01.28	01.60
25	481-500	62.0	77.0	36.5	46.0	54.0	67.0	30.5	38.5	01.31	01.63

[1] Effective Aug. 26, 1920. Rates quoted are not applicable to shipments when service is performed wholly within the State of Massachusetts.

[2] Rates for less-than-carload shipments in milk or refrigerator cars (iced in summer and heated in winter) on milk, passenger, or mixed passenger and freight trains; also applicable to shipments in baggage cars (no icing) on passenger trains between points where milk or refrigerator cars (iced or heated) are provided.

[3] Rates for less-than-carload shipments, in bottles or in milk or refrigerator cars (iced in summer and heated in winter) on milk, passenger, or mixed passenger and freight trains; also applicable to shipments in baggage cars (no icing) on passenger trains between points where milk or refrigerator cars (iced or heated) are provided.

[4] Rates for carload shipments in milk or refrigerator cars, on milk, passenger, or mixed passenger and freight trains; ice furnished by shipper.

[5] Rates for carload shipments in bottles, in milk or refrigerator cars, on milk, passenger, or mixed passenger and freight trains; ice furnished by shipper.

[6] Rates per quart for carload shipments in tank cars, in milk or refrigerator cars, on milk, passenger, or mixed passenger and freight trains; minimum 9,440 quarts; ice furnished by shipper.

TABLE 13.—*New schedule of rail rates*[1] *on milk and cream, New England territory*

[Source: Inter state Commerce Commission Tariff Schedule No. 4834]

Zone	Distance	Less than carload shipments				Car-lot shipments				Tank car per quart [6]	
		Per 40-quart can [2]		Per 12-quart case [3]		Per 40-quart can [4]		Per 12-quart case [5]			
	Miles	Milk	Cream	Milk	Cream	Milk	Cream	Milk	Cream	Milk	Cream
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1	1- 20	21.0	26.5	12.0	15.0	18.5	23.0	9.0	11.5	0.43	0.54
2	21- 40	25.0	31.5	15.0	19.0	22.0	27.5	11.5	14.5	.53	.66
3	41- 60	29.0	36.5	17.5	22.0	25.5	32.0	13.5	17.0	.62	.78
4	61- 80	32.5	40.5	19.0	23.5	28.5	35.5	15.0	19.0	.70	.88
5	81-100	35.5	44.5	19.0	23.5	31.0	39.0	15.0	19.0	.77	.96
6	101-120	37.0	47.0	19.0	23.5	32.5	41.0	15.0	19.0	.79	.99
7	121-140	39.5	49.0	20.5	26.0	34.0	43.0	17.0	20.5	.84	1.05
8	141-160	41.5	51.5	21.5	27.0	36.0	45.0	17.5	22.0	.88	1.10
9	161-180	43.0	54.0	23.0	29.0	38.0	47.0	18.5	23.5	.92	1.15
10	181-200	45.0	56.0	24.0	30.0	39.0	49.0	20.0	24.5	.96	1.20
11	201-220	47.0	58.0	25.0	31.0	41.0	51.0	20.5	26.0	1.01	1.26
12	221-240	48.0	60.0	26.0	32.5	42.0	53.0	21.5	27.0	1.02	1.28
13	241-260	50.0	62.0	27.0	33.5	43.0	54.0	22.0	27.5	1.07	1.34
14	261-280	51.0	63.5	27.5	35.0	45.0	56.0	23.0	29.0	1.09	1.36
15	281-300	53.0	66.0	29.0	36.0	46.0	57.5	24.0	29.5	1.13	1.41
16	301-320	54.0	68.0	29.5	37.0	47.5	59.5	24.5	30.5	1.16	1.45
17	321-340	56.0	69.5	30.5	38.0	48.5	60.5	25.0	32.0	1.20	1.50
18	341-360	57.0	71.0	31.0	39.0	50.0	62.5	26.5	32.5	1.22	1.53
19	361-380	58.0	72.5	32.5	40.0	51.0	63.5	27.0	33.5	1.24	1.55
20	381-400	59.5	74.5	33.0	41.0	52.0	65.0	27.5	34.0	1.27	1.59

[1] Effective June 10, 1927. Rates quoted are not applicable to shipments when service is performed wholly within the State of Massachusetts.

[2] Rates per can for less-than-carload shipments in milk or refrigerator cars (iced in summer and heated in winter), on milk, passenger, or mixed passenger and freight trains; also applicable to shipments in baggage cars (no icing) on passenger trains between points where milk or refrigerator cars (iced or heated) are provided.

[3] Rates for less-than-carload shipments, in bottles, or in milk or refrigerator cars (iced in summer and heated in winter) on milk, psasenger, or mixed passenger and freight trains; also applicable to shipments in baggage cars (no icing) on passenger trains between points where milk or refrigerator cars (iced or heated) are provided.

[4] Rate per can for carload shipments in milk or refrigerator cars, on milk, passenger, or mixed passenger and freight trains; ice furnished by shipper.

[5] Rates for carload shipments in bottles, in milk or refrigerator cars on milk, passenger, or mixed passenger and freight trains, ice furnished by shipper.

[6] Rates per quart for carload shipments in tank cars, on milk, passenger, or mixed passenger and freight trains; the minimum to be the carrying capacity of tank, but not less than 8,925 quarts; ice furnished by shipper.

TABLE 14.—*Rail rates per 40-quart can on milk and cream in the New York territory*[1]

[Rates for zones 1 to 12 are from schedules of rates prescribed by the New York Public Service Commission. Rates for zones 13 to 40 are from Interstate Commerce Commission Tariff Schedule No. 882.]

Zone	Distance	Less-than-car-lot shipments		Car-lot shipments	
		Milk	Cream	Milk	Cream
	Miles	*Cents*	*Cents*	*Cents*	*Cents*
1	1- 10	23.5	29.5	20.5	26.0
2	11- 20	24.5	31.0	21.5	27.0
3	21- 30	26.5	33.0	23.0	29.0
4	31- 40	27.5	35.0	24.5	30.5
5	41- 50	29.5	36.5	26.0	31.0
6	51- 60	30.5	38.5	27.0	33.5
7	61- 70	32.0	39.5	27.5	35.0
8	71- 80	33.0	41.5	29.0	36.0
9	81- 90	34.0	42.5	30.0	37.0
10	91-100	35.5	44.0	30.5	38.5
11	101-110	36.0	45.0	32.0	39.5
12	111-120	37.0	47.0	32.5	41.0
13	121-130	38.5	48.0	33.5	42.0
14	131-140	39.5	49.0	34.0	43.0
15	141-150	40.0	50.5	35.5	44.0
16	151-160	41.5	51.5	36.0	45.0
17	161-170	42.0	53.0	36.5	46.0
18	171-180	43.0	53.5	38.0	47.0
19	181-190	44.0	54.5	38.5	48.0
20	191-200	45.0	56.0	39.0	48.5
21	201-210	45.5	57.0	40.0	50.0
22	211-220	47.0	58.0	41.0	51.0
23	221-230	47.5	59.0	41.5	51.5
24	231-240	48.0	60.0	42.0	53.0
25	241-250	48.5	61.0	42.5	53.5
26	251-260	50.0	62.0	43.0	54.0
27	261-270	50.5	63.0	44.0	55.0
28	271-280	51.0	63.5	44.5	56.0
29	281-290	51.5	65.0	45.0	56.5
30	291-300	53.0	65.5	46.0	57.5
31	301-310	53.5	66.5	47.0	58.0
32	311-320	54.0	68.0	47.5	59.0
33	321-330	54.5	68.5	48.0	60.0
34	331-340	56.0	69.5	48.5	60.5
35	341-350	56.5	70.0	49.0	62.0
36	351-360	57.0	71.0	50.0	62.5
37	361-370	57.5	72.0	50.5	63.0
38	371-380	58.0	72.5	51.0	63.5
39	381-390	59.0	74.0	51.5	64.0
40	391-400	59.5	74.5	52.0	65.0

[1] Shipped in milk or refrigerator cars on milk, passenger, or mixed passenger and freight trains, iced when necessary, to Melrose Junction, or One hundred and thirtieth Street, New York.

TABLE 15.—*Car-lot freight rates on cream, fast passenger service, from mid-western points to Boston, 1926*[1]

[Data obtained from freight department, Boston & Albany R. R.]

Shipping point	Rail miles to Boston	Rate per 40-quart can
	Miles	*Dollars*
Kansas, Hutchinson	1,715	2.28½
Iowa, Waterloo	1,321	2.08½
Minnesota:		
Watertown	1,176	2.27½
Minneapolis	1,467	2.21½
Northfield	1,458	2.18½
St. Paul	1,456	2.19½
Wisconsin:		
Rice Lake	1,415	2.16½
Reedsburg	1,228	1.98½
Ripon	1,215	1.97½
Lodi	1,195	1.95½
Milwaukee	1,131	1.85
Illinois, Chicago	1,046	1.44½
Michigan, Homer	861	1.27

[1] Via lines west of Chicago, Michigan Central, New York Central, and Boston & Albany R. R.'s.

TABLE 16.—*American Railway Express mileage scale on buttermilk, cream, curd, milk, condensed milk in bulk, and pot cheese in ordinary milk cans* [1]

[Source: Interstate Commerce Commission Tariff Schedule No. 3281, rates effective Jan. 5, 1927, beteewn points in Connecticut, Delaware, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Vermont, and West Virginia; also on interline traffic between the above and the Dominion of Canada]

Distance	Rate per 100 pounds	
	Milk	Cream
Miles	*Cents*	*Cents*
1– 25	37	44
26– 50	44	54
51– 75	53	61
76–100	60	68
101–150	74	84
151–200	83	90
201–250	90	97
251–300	97	104
301–400	104	113
401–450	113	120
451–500	120	127
501–550	127	134
551–600	134	141
601–650	141	148
651–700	148	155
701–750	155	162

[1] If the company performs vehicle service in connection with such empties charge one-half second-class rate per 100 pounds. Pound rates minimum 16 cents per shipment.

Cars containing milk or cream originating at points in Canada and destined for points in the United States may be stopped for partial loading at one point in Canada directly intermediate on the through route between point of origin and destination without additional charge. Such shipments if forwarded in refrigerator cars will be subject to the rate herein from original point of shipment to final destination, on total lading of car, minimum weight 15,000 pounds. If forwarded in equipment other than refrigerator, the minimum will be 12,000 pounds.

Shipments carried at rates shown in this tariff are subject to charges at pound rates, minimum charge 32 cents.

Shipments in ordinary milk cans, estimate at 10 pounds per gallon on full capacity of can whether filled or partly filled. When in cans packed in ice in boxes or in other outside covering, or in refrigerator or vacuum cans, 20 per cent must be added to charge applicable to shipments in ordinary milk cans, but the charge so made must not be more than the second-class charge on the actual gross weight.

Empty cans, returned by the company which carried them when full, must be receipted for and, when delivered at the depot by the shipper and taken from the depot at destination, must be returned free. If the company performs vehicle service in connection with such empties the charges in item 2, page 37 of classification No. 29, supplements thereto and subsequent issues thereof will apply.

Buttermilk, milk, and cream in bottles must be charged second-class rates.

TABLE 17.—*Cream shipments to Boston and Springfield, Mass., from midwestern points (40-quart containers of 40 to 45 per cent cream), January, 1925, to April, 1927*

[Data obtained from records of the Boston & Albany R. R.]

Shipping point	January, 1925–April, 1925		November, 1925–March, 1926		November, 1926–April, 1927	
	Boston	Springfield	Boston	Springfield	Boston	Springfield
Bloomer, Wis	200					
Chicago, Ill	1,200		1,000			
Columbus, Wis					1,232	
Elkhorn, Wis					200	
Homer, Mich		200	200			
Hutchinson, Kans			400			200
Hutchinson, Minn			1,600	800	400	
Lodi, Wis	200				835	
Marshfield, Wis	200		800			
Milwaukee, Wis			3,000		6,875	
Minneapolis, Minn	2,400		800	200	1,400	800
Northfield, Minn					200	
Ottawa, Kans			816		2,000	
Reedsburg, Wis	800		1,000		200	
Rice Lake, Wis			800		400	
Ripon, Wis	600		1,400			
St. Paul, Minn					400	400
Waterloo, Iowa	600		1,000	400	3,000	3,396
Watertown, Minn			400		2,075	3,725
Watertown, Wis			400			
Wichita, Kans					200	
Janesville, Wis				200		
Total	6,200	200	13,616	1,600	19,417	8,521

TABLE 18.—*Imports of cream into United States customs districts 1, 2, 7, and 9—September, 1922, to December, 1926* [1]

[Data from U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce]

Year and month	Gallons of cream imported into district No.—				Year and month	Gallons of cream imported into district No.—			
	1	2	7	9		1	2	7	9
1923 [2]					1924				
January	51	61, 285	169, 452	23, 305	January	84	50, 931	33, 283	29, 474
February	43	49, 666	97, 960	25, 683	February	38	35, 425	17, 137	29, 843
March	45	91, 292	133. 563	30, 938	March	37	75, 550	30, 005	30, 010
April	35	134, 021	167, 998	39, 136	April	99	139, 438	55, 055	31, 596
May	242	235, 219	360, 872	46, 517	May	146	208, 544	140, 940	48, 089
June	68	333, 007	628, 446	70, 876	June	54	324, 670	165, 315	50, 650
July	136	356, 465	565, 276	64, 212	July	298	363, 056	194, 372	63, 657
August	------	324, 516	309, 232	54, 365	August	230	301, 876	176, 761	70, 210
September	------	273, 126	290, 892	44, 243	September	------	259, 211	136, 026	53, 605
October	100	242, 871	427, 284	41, 821	October	------	169, 322	85, 661	58, 250
November	17	170, 924	347, 608	40, 099	November	------	110, 697	91, 724	45, 892
December	247	123, 088	1, 016, 177	43, 413	December	89	89, 962	92, 756	48, 833
Total	984	2, 395, 480	4, 514, 760	524, 608	Total	1, 075	2, 188, 682	1, 219, 035	560, 109

Year and month	Gallons of cream imported into district No.—				Year and month	Gallons of cream imported into district No.—			
	1	2	7	9		1	2	7	9
1925					1926				
January	33	51, 825	47, 440	42, 258	January	9	48, 509	59, 756	29, 541
February	14	35, 453	49, 189	36, 860	February	12	36, 751	32, 843	31, 791
March	44	76, 609	62, 784	34, 464	March	26	80, 791	38, 792	26, 384
April	------	165, 201	113, 233	45, 559	April	20	138, 063	72, 628	23, 480
May	23	287, 095	224, 584	43, 623	May	11	239, 037	232, 146	34, 620
June	------	436, 325	317, 964	54, 050	June	4	388, 631	167, 252	47, 330
July	------	389, 529	256, 951	42, 360	July	5	391, 533	220, 742	69, 760
August	50	343, 133	165, 131	47, 210	August	------	368, 262	253, 976	70, 685
September	22	312, 103	171, 448	53, 982	September	------	335, 679	238, 831	66, 590
October	35	216, 352	129, 566	48, 708	October	------	284, 580	258, 977	53, 010
November	------	138, 152	106, 531	51, 569	November	------	181, 866	167, 032	39, 217
December	------	84, 922	101, 704	57, 130	December	------	134, 985	134, 558	35, 329
Total	221	2, 536, 699	1, 746, 525	557, 773	Total	87	2, 628, 687	1, 877. 533	527, 737

[1] District 1, Maine district, includes the States of Maine and New Hampshire, except Coos County, N. H. District 2, Vermont district, includes the State of Vermont and Coos County, N. H. District 7, St. Lawrence district, includes the counties of Clinton, Essex, Franklin, St. Lawrence, Jefferson, and Lewis, N. Y. District 9, Buffalo district, includes the counties of Niagara, Erie, Cattaraugus, and Chautauqua, N. Y.

[2] Includes some milk.

TABLE 19.—*Manufacturers' relative wholesale selling prices of butter and cheese, on the New York and Boston markets, 1920–1926*

Year and month	Relative price of creamery butter 92-score extra, on the Boston market [1]	Relative price of colored average fancy whole-milk cheese on the New York market [1]
1920		
January	201.0	203.2
February	202.6	191.0
March	209.3	184.9
April	212.8	185.8
May	189.2	193.1
June	179.7	180.7
July	179.7	170.3
August	177.0	172.0
September	184.4	180.1
October	183.3	170.7
November	186.0	161.9
December	169.3	146.4
1921		
January	166.3	149.6
February	147.4	148.0
March	151.3	159.3
April	143.4	138.7
May	101.3	100.6
June	103.4	97.3
July	127.7	119.7
August	133.7	131.7
September	137.5	133.9
October	145.8	141.5
November	140.6	136.0
December	135.6	133.0
1922		
January	116.6	131.7
February	115.5	126.2
March	120.1	131.0
April	119.4	114.8
May	115.4	109.5
June	116.3	124.1
July	115.1	133.2
August	113.5	130.4
September	127.7	145.2
October	141.9	161.6
November	156.1	169.8
December	170.7	175.4
1923		
January	163.0	175.2
February	160.0	165.5
March	160.8	161.8
April	149.7	140.8
May	133.7	146.0
June	124.5	157.6
July	123.7	157.7
August	137.8	161.8
September	146.2	168.7
October	150.7	165.8
November	163.9	156.1
December	168.7	139.1
1924		
January	167.4	132.7
February	162.8	132.6
March	149.7	128.6
April	123.3	102.9
May	123.0	103.6
June	129.3	119.7
July	126.4	124.3
August	120.6	125.3
September	120.2	131.1
October	120.4	121.7
November	130.8	127.8
December	140.3	141.5
1925		
January	124.9	150.5
February	128.5	150.1
March	148.2	152.2
April	143.4	140.1
May	134.8	130.6
June	136.0	139.5
July	136.5	144.8
August	137.5	151.7
September	150.7	150.9
October	158.4	163.1
November	158.0	160.6
December	153.8	164.5
1926		
January	140.7	161.8
February	141.9	166.3
March	134.6	153.8
April	124.5	126.9
May	128.7	125.3
June	129.4	135.0
July	127.7	141.5
August	130.5	140.7
September	139.0	146.4
October	145.4	149.6
November	150.9	157.7
December	164.3	163.9

[1] 1913 prices from U. S. Bureau of Labor Statistics=100.

TABLE 20.—*Manufacturers' relative wholesale selling prices for condensed whole milk, f. o. b. distributing points in New England, 1920–1926*

Year and month	Relative price [1]	Year and month	Relative price [1]	Year and month	Relative price [1]
1920		1922		1924	
January	171.6	May	78.5	September	89.2
February	154.0	June	85.6	October	92.0
March	141.2	July	90.4	November	92.7
April	143.0	August	93.5	December	93.5
May	209.2	September	98.1		
June	211.4	October	99.9	1925	
July	209.5	November	109.4	January	95.9
August	192.6	December	114.9	February	96.1
September	174.2			March	95.9
October	158.9	1923		April	96.1
November	142.7	January	115.2	May	93.3
December	114.0	February	114.1	June	99.9
		March	112.5	July	99.9
1921		April	115.8	August	101.1
January	119.3	May	116.0	September	95.9
February	109.1	June	115.2	October	98.1
March	116.5	July	116.6	November	97.5
April	116.0	August	117.3	December	97.5
May	100.7	September	113.3		
June	96.8	October	112.3	1926	
July	100.1	November	107.0	January	96.7
August	101.8	December	107.8	February	98.4
September	96.1			March	95.6
October	92.6	1924		April	93.9
November	86.8	January	103.5	May	91.8
December	84.2	February	101.5	June	92.7
		March	99.9	July	94.0
1922		April	101.9	August	93.3
January	87.2	May	101.1	September	92.0
February	79.4	June	99.1	October	92.9
March	77.7	July	92.2	November	92.8
April	77.3	August	92.0	December	94.1

[1] Monthly average price, 1921 to 1925=100.

TABLE 21.—*Manufacturers' relative wholesale selling prices for condensed skim milk, f. o. b. distributing points in New England, 1920–1926*

Year and month	Relative price [1]	Year and month	Relative price [1]	Year and month	Relative price [1]
1920		1922		1924	
January	201.8	May	74.4	September	96.1
February	196.6	June	72.0	October	91.8
March	172.0	July	84.2	November	91.0
April	163.5	August	89.9	December	102.7
May	253.8	September	100.5		
June	267.8	October	107.5	1925	
July	261.1	November	124.7	January	90.7
August	215.5	December	119.5	February	93.4
September	193.2			March	92.7
October	175.5	1923		April	95.1
November	148.0	January	120.4	May	93.7
December	116.0	February	114.6	June	101.4
		March	115.4	July	101.3
1921		April	119.0	August	102.9
January	103.7	May	123.9	September	99.4
February	93.7	June	126.0	October	100.5
March	103.3	July	128.8	November	98.4
April	105.1	August	127.4	December	97.3
May	102.9	September	122.2		
June	99.1	October	119.8	1926	
July	91.5	November	117.6	January	97.6
August	91.3	December	112.4	February	97.0
September	97.3			March	90.5
October	92.7	1924		April	91.3
November	80.1	January	109.2	May	89.7
December	73.1	February	105.7	June	93.1
		March	105.2	July	90.4
1922		April	102.4	August	86.2
January	72.9	May	99.4	September	88.9
February	75.8	June	97.3	October	90.7
March	71.1	July	94.2	November	90.7
April	71.8	August	93.2	December	93.7

[1] Average monthly price, 1921 to 1925=100.

TABLE 22.—*Manufacturers' relative wholesale selling prices for dry skim milk, f. o. b. distributing points in New England, 1921–1926*

Year and month	Relative price [1]	Year and month	Relative price [1]	Year and month	Relative price [1]
1921		1923		1925	
January	103.4	January	123.5	January	78.7
February	103.4	February	123.5	February	86.9
March	103.4	March	117.1	March	87.8
April	103.4	April	112.6	April	91.5
May	105.2	May	119.0	May	94.3
June	105.2	June	124.5	June	94.3
July	105.2	July	128.1	July	98.8
August	105.2	August	128.1	August	97.9
September	105.2	September	123.5	September	97.0
October	103.4	October	123.5	October	97.0
November	98.8	November	114.4	November	97.0
December	96.1	December	114.4	December	97.0
1922		1924		1926	
January	82.4	January	109.8	January	97.0
February	86.9	February	109.8	February	109.8
March	80.5	March	100.7	March	97.0
April	85.1	April	90.6	April	97.0
May	85.1	May	81.4	May	97.0
June	86.9	June	89.7	June	[2] 86.9
July	86.9	July	94.3	July	[2] 96.1
August	91.5	August	85.1	August	[2] 91.5
September	86.9	September	80.5	September	[2] 94.3
October	98.8	October	85.1	October	[2] 100.7
November	109.8	November	85.1	November	[2] 100.7
December	112.6	December	85.1	December	[2] 98.8

[1] Average monthly price, 1921 to 1925=100.
[2] F. o. b. Boston after May, 1926.

TABLE 23.—*Manufacturers' relative wholesale selling prices for casein on the New York market, 1920–1925* [1]

Year and month	Relative price [2]	Year and month	Relative price [2]	Year and month	Relative price [2]
1920		1922		1924	
January	136.0	May	72.0	September	84.0
February	136.0	June	96.0	October	84.0
March	136.0	July	104.0	November	84.0
April	136.0	August	120.0	December	80.0
May	136.0	September	144.0		
June	132.0	October	128.0	1925	
July	132.0	November	144.0	January	100.0
August	132.0	December	98.4	February	100.0
September	132.0			March	104.0
October	128.8	1923		April	100.0
November	128.0	January	132.0	May	96.0
December	124.8	February	132.0	June	96.0
		March	132.0	July	100.0
1921		April	184.0	August	104.0
January	117.6	May	180.0	September	108.0
February	104.0	June	140.0	October	108.0
March	111.2	July	132.0	November	100.0
April	107.2	August	132.0	December	100.0
May	72.8	September	124.0		
June	68.8	October	124.0	1926	
July	58.4	November	84.0	January	102.4
August	56.0	December	88.0	February	103.2
September	59.2			March	108.8
October	60.0	1924		April	126.4
November	66.4	January	100.0	May	135.2
December	67.2	February	100.0	June	138.4
		March	88.0	July	140.8
1922		April	96.0	August	136.0
January	64.0	May	96.0	September	128.8
February	68.0	June	84.0	October	126.4
March	72.0	July	84.0	November	124.0
April	72.0	August	88.0	December	124.0

[1] Based on quotations from Oil, Paint, and Drug Reporter.
[2] Average monthly price 1921 to 1925=100.

APPENDIX C

A SELECTED BIBLIOGRAPHY ON MARKETING FLUID MILK

AMERICAN INSTITUTE OF COOPERATION.

1925–26. AMERICAN COOPERATION. v. 2, 1925; v. 2, 1926, Washington, D. C. American Institute of Cooperation.

Collections of papers and discussions comprising the summer sessions of the American Institute of Cooperation. Dairy industry: 1925, v. 2, p. 3–328; 1926, v. 2, p. 5–222.

BALDERSTON, R. W.

1925. MARKETING FLUID MILK IN PHILADELPHIA. Ann. Amer. Acad. Polit. and Social Sci. 117: 231–242.

A descriptive account of how milk producers and dealers joined forces to serve a city.

[CONNECTICUT] DAIRY AND FOOD COMMISSIONER.

1923. AN ACT CONCERNING THE PRODUCTION AND MARKETING OF MILK AND CREAM AND RULES AND REGULATIONS RELATING THERETO. Ed. 4, 42 p. Hartford, Conn. (Bul. 7.)

DAIRYMEN'S LEAGUE COOPERATIVE ASSOCIATION, INC.

[1923–26]. STORY OF THE YEAR. 1922/23, 51 p., illus.; 1924/25, 43 p., illus.; 1925/26, 41 p., illus. [New York.]

Illustrated reports of the work of each year.

ELSWORTH, R. H., and WANSTALL, G.

1925. COOPERATIVE MARKETING OF MILK AND CREAM, 1924. A PRELIMINARY REPORT. 21 p. Washington, D. C. [Mimeographed.] (U. S. Dept. Agr., Bur. Agr. Econ., Div. Coop. Marketing.

Information compiled from the reports of 128 enterprises, with many tables and charts.

ERDMAN, H. E.

1921. THE MARKETING OF WHOLE MILK. 333 p., illus. New York.

Among the subjects discussed are the following: Milk as a market commodity, the markets for whole milk, distribution of milk, collective bargaining for sale, prices, proposed remedies.

EZEKIEL, M.

1924. PRACTICES WHICH DETERMINE PROFIT OR LOSS IN MILK PRODUCTION IN SOUTHEASTERN PENNSYLVANIA. PRELIMINARY REPORT BASED ON THE CONDUCT OF THE DAIRY ENTERPRISE ON 357 FARMS IN CHESTER COUNTY, PENNSYLVANIA, DURING THE FARM YEAR 1922–1923. [16 p.] Washington, D. C. (U. S. Dept. Agr., Bur. Agr. Econ.)

Mainly a study of feeds and feeding.

JESNESS, O. B., BARBER, W. H., SWARTHOUT, A. V., and CLEMENT, C. E.

1922. PRODUCERS' COOPERATIVE MILK-DISTRIBUTING PLANTS. U. S. Dept. Agr. Bul. 1095, 44 p.

Suggestions for establishing plants, including details regarding organization of a company, obtaining and equipping building, selecting a manager, keeping records, accounts, etc.

KING, C. L.

[1920.] THE PRICE OF MILK. 336 p., illus. Philadelphia.

A study covering price of milk to producers, cost of distributing, and fair-price policies.

MCFALL, R. J.

1925. THE NEW ENGLAND DAIRY MARKET. A PRELIMINARY REPORT. 59 p. Washington, D. C. [Mimeographed.] (U. S. Dept. Agr., Bur. Agr. Econ.)

MASSACHUSETTS DEPARTMENT OF AGRICULTURE, DIVISION OF MARKETS.

1925. SOME FACTS ABOUT THE USE OF MILK IN METROPOLITAN BOSTON. 23 p. Boston, Mass. [Typewritten.]

A study of the use of milk in hotels, restaurants, and homes in metropolitan Boston.

NATIONAL COOPERATIVE MILK PRODUCERS' FEDERATION.
[1925]. [REPORT OF] NINTH ANNUAL MEETING HELD AT PHILADELPHIA, PA., NOVEMBER 24–25, 1925. 54 p. [Mimeographed.]

NATIONAL MILK PRODUCERS' FEDERATION.
[1922]. [REPORT OF] SIXTH ANNUAL MEETING . . . SPRINGFIELD, MASSACHUSETTS, NOVEMBER 9–11, 1922. 99 p. [Mimeographed.]

PIRTLE, T. R.
[1926]. HISTORY OF THE DAIRY INDUSTRY. 645 p., illus. Chicago, Ill.

A comprehensive history of the industry, ancient and modern, in many countries.

ROSS, H. A.
1925. THE MARKETING OF MILK IN THE CHICAGO DAIRY DISTRICT. Ill. Agr. Expt. Sta. Bul. 269, p. 461–540, illus.

A description of some of the significant conditions surrounding the Chicago milk market. The agencies for distribution and the trend of consumption, designed as the basis for a plan for improving conditions.

ROSS, H. E.
1927. THE CARE AND HANDLING OF MILK. 342 p., illus. New York and London.

Designed as a textbook for dairy students and a guide for persons interested in the care and handling of milk.

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1926. INFORMATION ON THE DAIRY INDUSTRY ISSUED BY THE BUREAU OF AGRICULTURAL ECONOMICS. 26 p. [Mimeographed.]

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1925. PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE RELATIVE TO DAIRYING. 4 p. (Available for free distribution.)

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WILLARD, J. D.
[1924]. THE DAIRYING SITUATION. Mass. Agr. Col., Ext. Leaflet [80]. 5 p. [Mimeographed.]

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1924. PROCEEDINGS OF THE WORLD'S DAIRY CONGRESS . . . 1923. 2 v., illus. Washington, D. C. Government Printing Office.

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